White Paper Report

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Project Director: Rudyne Grigar (dgrigar@vancouver.wsu.edu)

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National Endowment for the Humanities – Digital Start-Up Grant

The Fort Vancouver Mobile project

Project director(s): Dr. Dene Grigar / Dr. Brett Oppegaard

Grantee institution: Washington State University Vancouver

Date submitted: June 1, 2013

Project description:

The Fort Vancouver Mobile project creates and investigates new forms of interactive narratives of historical significance, delivered through mobile technologies, focused on the emerging affordances of the medium. Development of this project was underway in the fall of 2010 -- with early prototypes and some local funding -- when this NEH Digital Start-Up Grant investment was made, to support the research team's work and to develop new material for the apps. The grant not only generated a significant burst of new multimedia material -- now in place at the research site, the Fort Vancouver National Historic Site in Vancouver, WA -- but it also served as a major catalyst for additional funding, larger collaborations with the National Park Service, educational advancements, more app development, national awards, and nationally and internationally distributed scholarship. In short, visitors to Fort Vancouver today can experience innovative interpretive media, through their mobile devices, and these free apps, because of this Digital Start-Up Grant, and this project has advanced the digital humanities field in several demonstrable ways, which will be outlined in this report.

Project activities:

Major activities that occurred during this granting period included:

- The public launch of Fort Vancouver Mobile apps (for Apple and Android devices) 1.0, with interactive narratives about the native Hawaiian population of the site and about Canadian artist Paul Kane's visit to the area in the mid-1800s, plus later updates that included new material documenting the official public opening of The Village, about the Old Apple Tree history, and the development of an extensive new module called A Villager's Tale, which specifically tells stories about women living on the frontier in the 19th century.
- Formal academic presentations about this project were given to attendees at the annual International Digital Media and Arts Association conference, in Savannah, GA, the Conference on College Composition and Communication, in St. Louis, MO, the International Communication Association preconference on Mobile Communication, Community and Locative Media, in Phoenix, AZ, the Digital Humanities Summer Institute in Victoria, B.C., the Electronic Literature Organization conference in Morgantown, VA, and the Technology, Knowledge, and Society conference in Vancouver, B.C., plus an additional talk at the annual Association of Partners for Public Lands convention in Las Vegas, NV, an invited presentation at the University of Pittsburgh, and various guest lectures on this topic on both the Pullman and Vancouver campuses of Washington State University.

- Academic articles were written about this project: “Teaching Mobile App Design and Development” in the Journal of International Design and Media Arts Association, expected to be published in the fall of 2013, and “The Interrelationships of Digital Storytelling Mobile Media” in “The Mobile Story: Narrative Practices with Locative Technologies,” expected to be published by Routledge, in the fall of 2013, as well as "Bodystorming with a Wood Block: Using Activity Theory and a Palm Pilot Progeny as an All-Purpose Prototype to Gather Formative and Contextual Mobile Design Ideas and Insights," submitted to the Mobile Media Communication journal, and “Effects of a Mobile App on Attention and Behaviors,” submitted to the Educational Technology & Society journal.
- The National Park Service designated this research a “National Call to Action” project, meaning it has special priority in terms of resources, funding, and in-kind support. It has been designated as a leading model for a service-wide initiative dubbed, “Go Digital!” And it has been aligned with the agency’s General Management Plan (GMP) and Long Range Interpretive Plan (LRIP), meeting or exceeding National Park Service standards.
- Additional grant funding was provided by both the Clark County Commissioners and Washington State University, plus significant in-kind contributions from the National Park Service as well as new researchers, who have joined the project in process, including expanded contributions from nearly every member of the Creative Media & Digital Culture faculty at WSU Vancouver.
- The project was woven into the curriculum of Digital Storytelling, Reporting Across Platforms, and other classes at WSU Vancouver, integrating dozens of students into the research and production processes.
- An installation exhibition of “The Art of Fort Vancouver Mobile,” filled the Nouspace Gallery and Media Lounge within the North Bank Gallery, in Vancouver, Wash., as part of a month-long faculty and student art show in December 2012.
- The development continued of the behind-the-scenes Fort Vancouver Mobile blog, www.fortvancouvermobile.net, which has attracted more than 25,000 page views, as well as the accompanying research blog on this topic, www.mobilestorytelling.net, with an additional 20,000 page views, and a related Twitter channel for @brettoppegaard, with more than 250 followers. In addition, a blog specifically about the creation process of the module called A Villager’s Tale was kept at http://dtc-wsuv.org/wp/fvm/.
- The two principal investigators (Dr. Grigar and Dr. Oppegaard) were chosen to represent higher education in the Pacific Northwest, during a Mobile App

Roundtable advisory group for senators Maria Cantwell (Washington) and Ron Wyden (Oregon) during a Congressional outreach session at ISITE Design in Portland, Ore.

- Dr. Oppegaard was chosen as both the regional and national volunteer of the year for the National Park Service, earning the George and Helen Hartzog Award, for his work on this project, chosen from among the 400 National Park Service sites, during which, in 2012, 257,000 volunteers donated 6.7 million hours. The media in this project also earned the John Wesley Powell Prize for outstanding historical displays, from the Society for History in the Federal Government.
- Media coverage of such major activities included the following:

The Columbian, March 15, 2013, "Fort project app-preciated." **Link:** http://www.columbian.com/news/2013/mar/15/fort-project-app-preciated/.

NW Crimson & Gray, spring 2013: "History goes mobile." **Link:** http://fortvancouvermobilesubrosa.blogspot.com/2013/04/northwest-crimson-gray-coverage-of.html.

WSU News, Oct. 29, 2012: "Outdoor, classroom teaching: Prof earns National Park Service award, NEH grant." **Link:** http://fortvancouvermobilesubrosa.blogspot.com/2012/10/wsu-news-coverage-of-hartzog-award-and.html.

The VanCougar, Oct. 11, 2012: "What it means to study at a top-tier research university." **Link:** http://fortvancouvermobilesubrosa.blogspot.com/2012/10/fvm-project-featured-in-open-campus.html.

National Park Service, "Oct. 10, 2012: "NPS Getaway." **Link:** http://fortvancouvermobilesubrosa.blogspot.com/2012/10/fvm-app-on-national-park-service-site.html.

The Oregonian, Sept. 18, 2012: "WSU Vancouver's new chancellor hopes to build more bridges to community." **Link:** http://www.oregonlive.com/clark-county/index.ssf/2012/09/wsu_vancouvers_new_chancellor.html.

Mana Magazine, July/August 2012: "Kanaka Village." **Link:** http://fortvancouvermobilesubrosa.blogspot.com/2012/08/fvm-project-featured-in-mana-magazine.html.

The Columbian, July 2, 2012: "Off beat: Coral passes scrutiny in Fort Vancouver Video." **Link:** http://www.columbian.com/news/2012/jul/02/coral-passes-scrutiny-in-fort-vancouver-video/.

The Columbian, June 6, 2012: "Fort Vancouver to host national parks' 'Get Outdoors Day' on Saturday." **Link:** http://www.columbian.com/news/2012/jun/06/fort-to-host-national-parks-get-outdoors-day-on-sa/.

The Daily Insider, June 1, 2012: "WSU Vancouver brings history to life with Ft. Vancouver app." **Link:** http://dailyinsider.info/wsu-vancouver-brings-history-to-life-with-ft-vancouver-app/.

The Columbian, April 22, 2012: "Local view: Fort Vancouver a national treasure." **Link:** http://www.columbian.com/news/2012/apr/22/fort-vancouver-a-national-treasure/.

The Columbian, Jan. 15, 2012: "App-ropriate stories: Fort Vancouver Mobile project brings history to life for smartphone users." **Link:** http://fortvancouvermobilesubrosa.blogspot.com/2012/01/columbian-coverage-of-fvm-app.html.

The Columbian, July 30, 2012: "In Our View: Cheers & Jeers. To a new smartphone app …" **Link:** http://www.columbian.com/news/2011/jul/30/cheers-jeers/.

During this app-creation process, significant changes in the mobile technological landscape occurred with the rapid development of HTML5 protocols, and with the advent of a program called PhoneGap, which allowed HTML5, and JavaScript commands to access phone hardware in similar ways to the native languages of the devices. This meant that instead of having to write completely different app code for each device (so, for example, an entire set of code for Apple, and a completely different set of code for Android, like what was originally required in the development realm), Phone Gap allowed one set of code to be written and moderately adjusted to work on multiple devices. This change involved dropping all of the code that had been written to date, and using a new batch of code, in Javascript, going forward. But in the long run, this change allows for quicker, more consistent, and higher quality app development and maintenance. In addition, our research team worked on tailoring the Google Maps API to allow for development of map overlays created for this project, which will allow visitors to geolocate themselves in the park, referencing historic maps, and to access media at specific places related to that locative awareness.

Accomplishments:

This account of the app accomplishments will not describe the dozens of meetings and site visits; the thousands of pages of historic source material perused, including maps, images, and journals, which then laboriously were remediated into digital forms; the countless number of informal conversations, ranging from information gathering exchanges to formal partnership building; or the innumerable dead ends as well as pilot tests and experiments that ensued. It also will not relist the many accomplishments already noted above. But it will focus upon the additional tangible products of the process, which included:

- That the Fort Vancouver Mobile app now has been downloaded more than 1,500 times.

- The Fort Vancouver Mobile project has become a model for the National Park Service, in terms of new media interpretation, and it has been widely circulated within the agency and beyond as an example of community-government partnerships that work. Such collaboration has included direct discussions with federal leaders, such as John Tobiason, New and Social Media coordinator for the National Park Service, with those meetings happening on the WSU Vancouver campus, at the Fort Vancouver National Historic Site, and at the Harpers Ferry Center in West Virginia, as well as additional national outreach within the agency, such as providing a program about mobile historical interpretation for the National Park Service's first ever Digital Media Webinar, attended by more than 90 employees from throughout national parks in the U.S. & territories (such as Virgin Islands, American Samoa, and Guam).
- The Digital Start-Up Grant not only produced new material for the A Villager's Tale module, but it also provided foundational support that stimulated other new modules, such as the journalistic extensions of mobile media in The Village Opening and The Old Apple Tree pieces, but also in a new tablet app, under development, funded by an additional "We the People" grant from the NEH, that repurposed some of this Fort Vancouver Mobile work, and inspired new media objects as well, to explore non-location-based storytelling and history education on larger mobile screens.

In terms of objectives of the application, all major proposed production objectives were achieved. After the grant funds were received, the research team, led by Dr. Grigar, identified specific mobile narrative opportunities related to gender issues in The Village, including investigating a wide range of potential characters and plotlines. The most promising pieces of that historic story were gathered and remediated into a mobile module called A Villager's Tale, through a lengthy and detailed process of script development, storyboarding, and app development, which integrated top undergraduate students in the Creative Media and Digital Culture program's Digital Storytelling course in the spring of 2012 and the senior seminar course in the fall of 2012. Regular review of the work was provided by Fort Vancouver National Historic Site staff, including Chief Ranger Greg Shine, who co-taught the Digital Storytelling class, and the advisory board of academics and historians. Usability testing and comparative prototyping of the app was conducted by Drs. Oppegaard and Still.

Content produced for the A Villager's Tale module included six videos, ranging in length from 1:05 to 3:42, available for general viewing at the Fort Vancouver Mobile YouTube channel, http://www.youtube.com/user/FortVancMobile?feature=mhee, plus additional text, maps, animations, and still images, including several historic images that were discovered by the design team and then added to the National Historic Site's collection.

A Villager's Tale was created as a metanarrative, presented as a series of videos in which Cassie Anderson, Park Ranger and Historic Programs Coordinator at the Fort, talks about life in The Village from a historic perspective. The second layer of the piece is a literary interpretation that parallels the historical information, with that story unveiling the life of a Métisse woman of Cree and French-Canadian heritage who comes to the Village with her fur-trapper husband. Her story unfolds as sound files, a series of photomontage, and maps. Unlike Cassie who is able to identify herself in her metanarrative, the fictional character of this story remains nameless and faceless throughout, reflecting the general anonymity of women during this period.

Both stories unfold in four episodes. These episodes center on Home, Family, Food, and Work and highlight major aspects of daily life at the Village. They also provide a narrative flow in that there is rising and falling action related to the hardships of life at the Village. The turning point occurs with a canoe accident involving our character and her children. Extensive research was undertaken to locate historical data to inform the story. A complete bibliography can be found at http://dtc-wsuv.org/wp/fvm/bibliography/. Pertinent material has been annotated and made available online for scholars interested in this topic to access. Students in the Digital Storytelling class generated this content as part of their course work.

Bonus narratives also created from the momentum of this grant funding include The Village Opening and The Old Apple Tree modules. The Village Opening is a journalistic prototype intended to begin the exploration of mobile place-based media as event coverage. It included geolocating the journalistic news coverage of the official opening ceremonies of The Village, by embedding videos and still images, while also integrating interactive elements. For example, during the opening ceremony, a parade of costumed characters and site visitors walked from the Columbia River, over the Land Bridge, to the Village site, singing a French voyageur song. That event was captured on video, and that video was edited and embedded at the site, through the app, so visitors today can walk in the footsteps of that parade, sing that same song, with lyrics provided karaoke style, and even record and upload their renditions to be melded into a choir-like blend. The Old Apple Tree module, also journalistic in nature, was created to document a community festival at the location of the oldest apple tree in Washington state. It includes historic photos strategically placed at the site to allow users of the app to watch how the area around this historic tree has changed over the past 100 years. While neither of those two modules were considered part of the scope of this original grant funding, the NEH support in this case provided the capacity for students and researchers to generate other new ideas in the process and develop those as well.

Audiences:

The National Park Service has strict rules about surveying on site, and visitor tracking, limiting significantly the amount of personal data that can be gathered from its visitors, as a way to protect the privacy of those people. The agency does keep annual visit tracking numbers, though, and estimates that the Fort Vancouver National Historic Site attracts about 1 million visitors per year, mostly from the Pacific Northwest but also with some national and international draw. Since broader demographic data gathering was not within the scope of this research, the assumption was made that the Fort Vancouver audience was a homogenized recreational audience, similar to those at other historic sites across the country.

Because of concerns about National Park Service restrictions, the app also did not track detailed analytics of use, other than just the most general statistics, such as the 1,500 downloads, about half from the Apple App Store and about half from the Google Play market.

Anecdotally, though, the Fort Vancouver staff has reported several interesting instances in which visitors, with the app but without the direct assistance of park staff, have been exploring the site in traditionally unusual ways. In The Village area, for example, the limited resources of the site rarely allows park rangers to circulate through the reconstructed houses, other than cursory sweeps. Because the houses are locked, and the analog media support in the area is limited to two wayside signs, rangers used to be surprised to encounter people in the location. Since the official public launch of the app, in June 2012, the rangers increasingly have been noticing not only more people in the area but also people who are taking their time, looking carefully at the details of the physical reconstruction, using their mobile devices to access digital media, and even people who are making media about their experiences at the site, with their mobile devices, one of the top goals of the interactive prompts within the app.

These audience evaluation experiences have led to two general conclusions:

1. Significantly more marketing and promotion efforts will be needed to dramatically increase the app audience size. While 1,500 downloads is a commendable response for a new place-based app like this, more direct prompting and hands-on marketing appears to be needed to encourage more visitors to download and try the app, including marketing material directly in the location where the app is available and likely to be used. At this point, because of site signage restrictions, app promotion is limited to the Visitors Center and ancillary media. Visitors to historic sites do not necessarily come to these places

thinking about how they might want to use their mobile devices, and they might even be coming with a negative attitude about mobile devices, along the lines of escapism from the phone. These visitors also have never seen an interpretive mobile app like this one (as opposed to the standard expositional app). So a more concerted promotional effort is needed to help people understand what this app does, how it could be valuable to them during the visit, and what topics are explored through the app experience, all of which could lead to more use and more feedback about such app development.

2. A deeper user profile should be created via app analytics, as a way to develop more precision and direct data feedback to the iteration cycle. This is technically possible and would be relatively simple to implement pragmatically. But, politically, and philosophically, more discussions about user privacy need to take place with the National Park Service, and any additional information gathered about users would need to be clearly identified to the users, as they choose to use the app, creating a tension that could lessen usage because of such privacy concerns.

Evaluation:

The Fort Vancouver Mobile app has been developed and evaluated in close collaboration with the National Park Service, and its staff at the Fort Vancouver National Historic Site. The site has a specific liaison focused on the project, Chief Ranger Greg Shine, and the superintendent of the site, Tracy Fortmann, plus numerous other staff members, directly have been reviewing and providing feedback as well. On the academic side, members of the Texas Tech University and Portland State University faculties have served in advisory roles while the core Creative Media and Digital Culture faculty at Washington State University Vancouver have been involved in evaluation of this project at every level. These evaluations have included detailed feedback via email exchanges, conference calls, and faculty meetings, and, at this point, there has been no issue raised that could not be solved through conversations and hard work.

Besides the strengths of this project, and some of the weaknesses, which have been covered already, other evaluation points to note:

- The Fort Vancouver Mobile project has become a community asset, and a source of community pride. Media coverage of the app and its successes has been extensive, and this project has generated an energy and a momentum in Southwest Washington for innovative app development, outside of just the academic arena.
- With each new media object created in this project, dozens of other great ideas also were generated, meaning the potential for future stages and expansion are high.

- Promotion, use analysis, and direct visitor marketing could be improved significantly.
- More observations of app use, usability testing, and focus groups would be beneficial.
- Technological maintenance of the app, upgrading and updating, will be an ongoing issue, which will need additional funding and attention. Conversations have been started with the National Park Service about that concern. Ways to access the material without wireless has been discussed using Raspberry Pi technology. Faculty in the CMDC program has developed a project that can make the media files available to visitors. We are working on the final version of this new technology for our project.

Continuation of the project:

The Fort Vancouver Mobile project, with the support of the NEH, has become a legacy project for faculty members at Washington State University Vancouver and staff members at the Fort Vancouver National Historic Site. It has been built to grow and thrive for many years to come. The multimedia design has been structured to withstand many generations of technological advancements, through Google glasses-like augmented headwear to computerized contact lenses and beyond, focusing on the place-based nature of the material and the potential for user activity and interaction with the digital media. The Clark County Commissioners, through their Historical Promotion Grant program, and WSU Vancouver already have committed new grants to future iterations of this project, and more grant proposals and new partnerships, such as a developing relationship with the National Parks Foundation, are being cultivated this year to ensure long-term stability and success of this effort. The Fort Vancouver Mobile blog, www.fortvancouvermobile.net, will continue to be updated and include current information on all aspects of this project as it evolves and grows in future years.

Long-term impact:

The Fort Vancouver Mobile project already has been spun off into a separate NEH-funded tablet app, mentioned earlier, dubbed the Grand Emporium of the West project. That app is being designed for use in middle school history classes nationwide, as part of the EDSITEment program, and it will explore ideas about media creation and interaction through non-place-based material of the same historic origin. Several other new modules of the Fort Vancouver Mobile app are under development already, including a grant-funded interactive narrative about the largest Spruce Mill plant in World War I, which made the boards for the fighter planes in Europe, which today is not much more than an empty field. The situation is reminiscent of what we started with in The Village, with the original Fort Vancouver Mobile idea, but now, with this NEH-

funded experience, we have a clear vision, a diverse set of tools, and well-formed ideas about what is possible, what is successful, and what we definitely want to research next.

Grant products:

Here are links to the primary grant-funded products of this research:

- The Fort Vancouver Mobile app: Apple (https://itunes.apple.com/us/app/fort-vancouver/id527262125?ls=1&mt=8), Android (https://play.google.com/store/apps/details?id=org.radiojoe.fort&feature=search_result).
- A Villager's Tale videos:
  1. A Villager's Tale: http://www.youtube.com/watch?v=6YIAyVka0Ws
  2. Home at the Village: http://www.youtube.com/watch?v=_z1wOMjymp8
  3. Family life: http://www.youtube.com/watch?v=bxiDIhS4a98
  4. What we ate: http://www.youtube.com/watch?v=GONlvAu90z0
  5. Our normal work day: http://www.youtube.com/watch?v=-ZcCeN0xhtc
  6. Conclusion: http://www.youtube.com/watch?v=h5FAMD1DkkQ
- The "Life of a Blacksmith" game; a hypertext narrative about surviving on the frontier.
- The "Lost and Found" guessing game; a quiz-like experience that shows users a historic artifact out of context and then, after the user tries to determine what the artifact was, provides the answer as well as the archaeological knowledge behind that information.
- The Fort Vancouver historic map overlay; using the Google Maps API, a large-scale overlay of the Fort Vancouver National Historic Site campus was created, and users are able to navigate the area physically while seeing where they also are walking historically.
- The Village Opening module; a prototype of embedded journalism at the site, this experience allows users to relive the day that The Village opened to the public as a historic attraction, including ceremonies, speeches, and festivities.
- The Old Apple Tree module; another journalistic prototype that shows the history of the Old Apple Tree, the oldest fruit tree in the Pacific Northwest, in a kind of time-lapse format, allowing users to experience the changes in time, through still photographs, around the tree.
- Digital Storytelling class curriculum, spring 2012, and Senior Seminar curriculum, fall 2013.
- Academic articles: "Teaching Mobile App Design and Development" in the Journal of International Design and Media Arts Association, expected to be published in the fall of 2013, and "The Interrelationships of Digital Storytelling

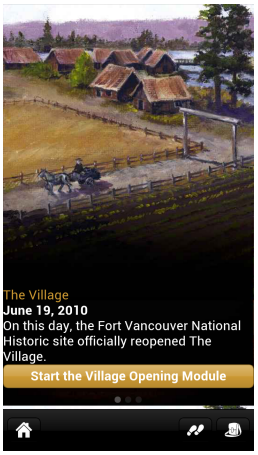
Mobile Media" in "The Mobile Story: Narrative Practices with Locative Technologies," expected to be published by Routledge, in the fall of 2013, as well as "Bodystorming with a Wood Block: Using Activity Theory and a Palm Pilot Progeny as an All-Purpose Prototype to Gather Formative and Contextual Mobile Design Ideas and Insights," submitted to the Mobile Media Communication journal, and "Effects of a Mobile App on Attention and Behaviors," submitted to the Educational Technology & Society journal; attached as appendices.

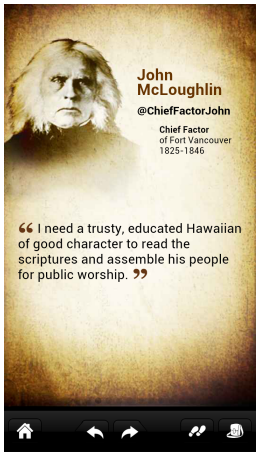
- A Villager's Tale blog, http://dtc-wsuv.org/wp/fvm/.
- The Fort Vancouver Mobile blog, www.fortvancouvermobile.net.
- The accompanying research blog, MobileStorytelling.net, www.mobilestorytelling.net.
- Twitter channel content at @dgrigar and @brettoppegaard
- Formal academic presentations at:
  1. The annual International Digital Media and Arts Association conference, in Savannah, GA.
  2. The Conference on College Composition and Communication, in St. Louis, MO.
  3. The International Communication Association preconference on Mobile Communication, Community and Locative Media, in Phoenix, AZ.
  4. The Digital Humanities Summer Institute in Victoria, B.C.
  5. The Electronic Literature Organization conference in Morgantown, VA.
  6. The Technology, Knowledge, and Society conference in Vancouver, B.C.
- Additional grant funding for this project was provided in 2012 by: The National Endowment for the Humanities ("We the People" grant, $19,000); The Clark County Commissioners (Historic Promotion Grant, $20,000); and WSU Vancouver (Research Mini-Grant, $4,000).
- "The Art of Fort Vancouver Mobile," an installation exhibit, filled the NouSpace Gallery and Media Lounge within the North Bank Gallery, in Vancouver, Wash., as part of a faculty and student art show in December 2012

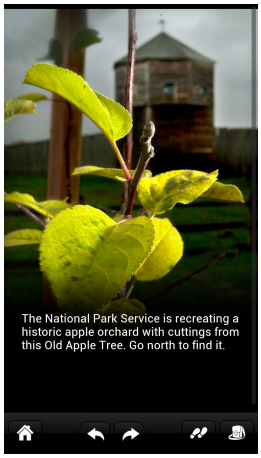
Appendices:

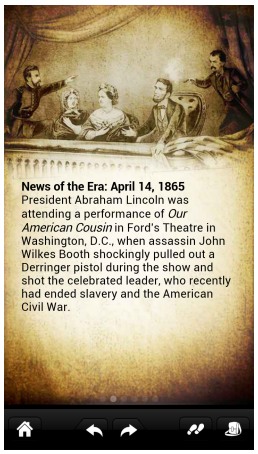
Appendix 1:

Sample screen shots









Appendix 2:

Sample syllabus

DTC 354 Digital Storytelling
Dr. Dene Grigar & Professor Greg Shine
TTH 1:25-2:40 p.m., VMMC 111
Office: VMMC 24; 546-9487
Email: dgrigar@vancouver.wsu.edu; greg.shine@gmail.com
Office Hours: TTH: 12-1 pm & by appointment
Class Website: http://web.me.com/dgrigar/354/Welcome.html

Introduction to the Course Content and Focus

This is a course in digital storytelling found in the curriculum of The Creative Media & Digital Culture Program (CMDC) at Washington State University Vancouver. It is broadly described in the university catalog as the study of "[n]onlinear, multi-linear, and interactive narrative using elements of creative writing such as character, dialog, setting, plot and image." The Chief Ranger at The Fort Vancouver National Historic Site Greg Shine and Dene Grigar, Director and Associate Professor in the CMDC program are team-teaching it with the aim of apprenticing students to develop multimedia content for the Fort Vancouver Mobile Project, mobile narratives funded by the National Endowment for the Humanities.

Because we need access to the artifacts and space at the Fort in order to produce the content for the project, the course is organized so that "Theory and Practice" is taught on Tuesdays in VMMC 111 on the WSUV campus and is led by Grigar, and "Fieldwork" is taught on Thursdays at the Fort and is led by Shine. Thus, during the semester students will not only learn the basics of storytelling, multimedia, and mobile design and development but also the history of the Fort from experts in history, archaeology, and anthropology. Major projects include:

- Written report on history learned about the Fort
- Production of a mobile narrative work

Additionally, numerous guest speakers are planned as well as an overnight camp-out at the Fort where participants will experience, firsthand, what life what have been like living in The Village during the Fur Trade Period.

Course Goals and Objectives

Students are expected to meet the Course Objectives and Outcomes for The CMDC Program associated with this course. They are:

> Goal 7. Recognize various forms of language processing and their implications for media authoring:
>
> A. Use digital media terminology and concepts, such as medium, media, multimedia, mass media, remediation, repurposing, translation, text, textuality, language, and code, appropriately in presentations and projects

B. Employ various types of texts, such as visual, auditory, kinetic, and kinesthetic texts, for appropriate mediums
C. Illustrate the way artificial systems acquire language
D. Demonstrate knowledge about the process by which is language is made via computers
E. Study, create, and critique digital text and its central role in human-computer interactions
F. Employ textual content in web pages and other digital interfaces or environments that respond to specific audience needs

Goal 10: Be practiced and capable communicators in all mediums

A. Create a digital text in a variety of mediums
B. Construct and deliver an argument focusing on the way the medium affects the message, audience, and other rhetorical components
C. Evaluate the effective use of language in a digital text

Assessment

To be successful in the course, students must 1) stay current with all of the required assignments that lead to completion of their projects, 2) participate in class activities, 3) attend all classes, 4) turn in all assignments on time. Work will also be assessed for its professional quality. Other factors considered in the assessment of work include being turned in on time, uniqueness, and, of course, content. Components that will be assessed are:

Written report on history learned about the Fort:	25%
Production of a mobile narrative work:	50%
Participation and attendance:	25%

Items turned in late will be penalized a letter grade per day (not class day but each day) late. Items not turned in cannot be made up by other work.

Books & Resources

1. *Exploring Fort Vancouver*, by Douglas Wilson & Theresa Langford, UW Press, 978-0-295-99158-0. $24.95

2. *Mobile Interface Theory*, by Jason Farman, Routledge Press, 978-0-415-87891-3. $34.95

3. Various books and articles.

Absenteeism

More than two unexcused absences will result in a final grade being lowered by one letter grade. Excused absences are defined as absences due to documented illnesses or deaths of close family

members. Vacations, scheduled doctor visits, family reunions, week-long getaways, forgetting the semester has already begun or that we are meeting for class, and other personal reasons do not count as excused absences. Students need to be in class on the days indicated in the Course Schedule. No exceptions. If students miss more than two weeks in a row, for any reason, he or she will be asked to drop the course and retake it when the student is better able to participate.

University Policies
Academic integrity is the cornerstone of the university and will be strongly enforced in this course. Any student found in violation of the academic integrity policy will be given an "F" for the course and will be referred to the Office of Student Conduct. For additional information about WSU's Academic Integrity policy/procedures please contact (360) 546-9573.

Disability Accommodations may be available if you need them in order to fully participate in this class because of a disability. Accommodations may take some time to implement so it is critical that you contact Disability Services as soon as possible. All accommodations must be approved through Disability Services, located in the Student Resource Center on the Lower Level of Student Services Center (360) 546-9138.

Emergency Notification System: WSU has made an emergency notification system available for faculty, students and staff. Please register at Zzusis with emergency contact information (cell, email, text, etc). You may have been prompted to complete emergency contact information when registering for classes on RONet. In the event of a Building Evacuation, a map at each classroom entrance shows the evacuation point for each building. Please refer to it. Finally, in case of class cancellation campus-wide, please check local media, the WSU Vancouver web page and/or http://www.flashalert.net/. Individual class cancellations may be made at the discretion of the instructor. Each individual is expected to make the best decision for their personal circumstances, taking safety into account. Safety plan website - http://safetyplan.vancouver.wsu.edu/

Important Dates and Deadlines: Students are encouraged to refer to the academic calendar often to be aware of critical deadlines throughout the semester. The academic calendar can be found at www.registrar.wsu.edu/Registrar/Apps/AcadCal.ASPX. Questions regarding the academic calendar can be directed to the Office of Student Affairs in VSSC 100 or call 360-546-9559.

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Week	Tuesday—WSUV Theory & Practice	Thursday—Fort Vancouver Field Work
Week 1	1/10 Introduction to course: readings, theories, hands-on practice, Fort Vancouver	1/12 Reading due: EFV, pp. 1-27 Tour of Fort Vancouver; presentation on research in action
Week 2	1/17 Introduction to mobile media Assign mid-term project	1/19 Reading due: EFV, Chs. 2 & 3 Presentation on Daily Life in the Village; House #2 & artifacts
Week 3	1/24 Read for mid-term project Online Research methods for non-	1/26 Reading due: EFV 4 & 5 Archaeology Studies; guest speaker from

	fiction storytelling	FV
Week 4	1/31 Read for mid-term project Presentation on Telling Digital Stories	2/2 Reading due: EFV, finish book Demo of Fort Vancouver Mobile; guest Brett Oppegaard & Brady Berkenmeier
Week 5	2/7 Read for mid-term project Presentation on Approaches to Mobile Storytelling (how stories and collections work in mobile media)	2/9 Read for mid-term project Presentation of women's lives at the Village
Week 6	2/14 Read for mid-term project Tutorial on how to write reports & produce presentational materials	2/16 Read for mid-term project Presentation on Native American lives at the Village
Week 7 Mid-Term	2/21 Reports due; presentations due	2/23 Meeting to discuss groups & teams for final projects
Week 8	2/28 Reading due: MM, Chs. 1 & 2 Introduction to mobile media prototyping & mapping stories; mobile app guidelines	3/1 Presentation of theories of interpretation
Week 9	3/6 Reading due: MM, Chs. 3 & 6 Studio time to conceptualize projects	3/8 Site visit to map stories & check data
Week 10	3/13 Spring Break	3/15 Spring Break
Week 11	3/20 Reading due: MM, Chs. 4 & 5 Presentation on the way design & development impacts digital storytelling	3/22 Presentation of digital media as interpretative tool; guest speaker, NPS?
Week 12	3/27 Reading due: Finish book Studio time to develop projects	3/29 Video shoot & audio taping
Week 13	4/3 Studio time to develop projects	4/5 Video shoot & audio taping
Week 14	4/10 Studio time to develop projects	4/12 Video shoot & audio taping
Week 15	4/17 Studio time to develop projects	4/19 Demo/present drafts of projects
Week 16	4/24 Usability testing	4/26 On-site usability testing
Week 17 Final Exam	5/1 Final project presentations?	5/3 Final project presentations?

DTC 354 Digital Storytelling
Major Project #1: Written Report about the History of Fort Vancouver

Introduction

For your first major project, you will choose among the secondary sources, below, and write a report on it. The goal of this project is to encourage you to learn more

information about the history of the Fort during the Fur Trade Period, particularly about women and domestic life during that time. By doing so, you will be possess more in-depth knowledge about the topic that you can draw upon for your mobile project, which constitutes the second major project to come.

Directions for the Report

3-5 pages, double-spaced, well-written, demonstrating college level writing skills. We will provide a template for the layout of the document. It does not matter to us if you use MLA, APA, or Chicago Style; just pick a style and be consistent with it. You will upload your document on your Word Press site so that everyone has access to it. The final step of your project an oral presentation, 5 minutes in length, where you note the major points of the text and provide a one-page handout to your colleagues.

Texts

These will be online at the website: dtc-wsuv.org/wp/fvm

Appendix 3:

Article 1

Teaching Mobile App Design & Development

by Dene Grigar, John Barber, Will Luers, Brett Oppegaard, Michael Rabby, and Aaron May
The Creative Media & Digital Culture Program, Washington State University Vancouver

About 350,000 mobile apps have been released since May 2011, and more than 77 percent of the people in the world now have mobile devices. About 5 billion dollars are projected to be spent on mobile advertising during the next five years. Those statistic are among the many to suggest that just as web design emerged as the territory to explore in the mid 1990s, app design constitutes the one to study today. Yet because of the newness of the field and the fact that much of app development has generated from commercial and a "DIY" sensibility, teaching app design and development is not yet common in academic institutions.

This growth in mobile media and the dearth of pedagogical models prompted the faculty of The Creative Media & Digital Culture Program at Washington State University Vancouver to work together to find ways to integrate the teaching of app design and development into its curriculum. This move led them to create the Mobile Tech Research Institute (MTRI), a summer program that provided both undergraduates and faculty an opportunity to learn together how to work in the mobile medium but also gave faculty the imperative to build curriculum, pedagogies, and methodologies for teaching app design and development from the ground up. What we learned from that experience may be of interest to other digital media scholars and artists. Thus, this essay provides information about curriculum design, class projects and activities, technical requirements, teaching resources, and partnerships.

Part 1: Getting Started: Conceptualizing a Program in App Design and Development

At the outset, we envisioned the MTRI project as a two-year initiative that would involve a partnership between the university and the Southwest Washington region. In that regard, we imagined that if we could begin a systematic teaching of mobile media in our program and provide support for students with good ideas for app development, we could, in effect, help to rebuild the region's poor economy through this new, creative, green industry (See Fig. 1). To facilitate this vision, MTRI was originally conceptualized to contain four components: 1) a "Research Forum" that would bring in seven scholars and industry professionals in the area of mobile technology to work with community and students to develop local industry and projects, respectively; 2) "Coursework" in mobile app design and development for top undergraduates leading to the production of an app that would be used by regional non-profits and government; 3) "Training" in an Entrepreneur Incubator program that would provide support for students to create and

market their own individual app projects; and 4) "Collaboration" with a Mathematics Engineering Science Achievement (MESA) program where participants in an Entrepreneur Incubator would mentor and inspire K-12 students to pursue STEM-based careers. Because The CMDC Program has a strong community outreach tradition, the faculty developed the project so that the research questions we would seek to answer in the design and development of our app would be those needed by the larger Southwest Washington community. Thus, the 2011 Research Question was, "In what ways can mobile apps be created to improve services relating to health, education, culture, and art? What would such a tool look like?" The app we imagined building for that focus would have been one created for the county health office, the local school district, or a large arts organization. The 2012 Research Question asked, "In what ways can mobile apps be created to make government more responsive to constituents? What would such a tool look like?" This app would have been produced for our city or county, both of which did not yet have this kind of technology available for its constituents.

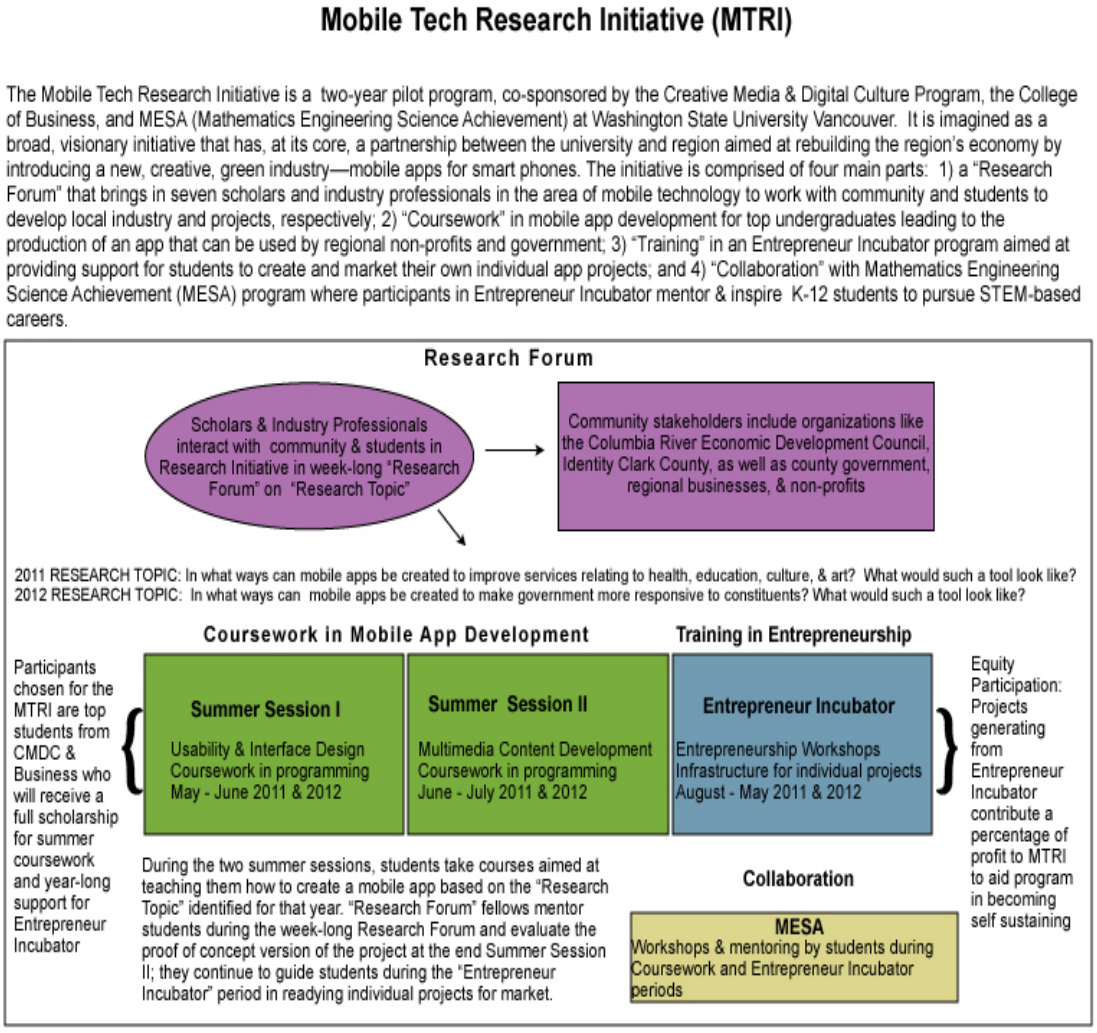

Figure 1. MTRI Plan

As a faculty without a graduate program, we were also looking for ways to interact with others undertaking research in this area, so that we could stretch our knowledge and understanding and share information we have about multimedia design and development. Some of us were already working on mobile projects. For example, Brett Oppegaard had begun the Fort Vancouver Mobile project in 2010 and had co-authored, with Dene Grigar, the National Endowment for the Digital Humanities Start-Up grant funded a few months later. Will Luers taught web-based app development in his web coding course. John Barber taught usability and interface design in his class and had been working with student groups to develop an app for The CMDC Program. What we needed, though, was a formal gathering, a research forum, that would provide us the opportunity to explore effective ways to integrate app technologies into culture and to examine what it meant to do so. Thus the "Research Forum" aimed to bring a combination of national thought leaders and local community leaders to campus to meet these two needs. We imagined that such a forum would inform the second step in our plan: "Coursework," a cohesive approach to teaching of app design and development. We imagined that the courses would take place during the summer during the two six-

week sessions and knew we needed to select top students with strong coding and designing skills in order for the plan to be successful. The students taking these courses would, then, create a mobile app based on the "Research Topic" identified for that year. "Research Forum" fellows were envisioned as mentoring students during the week-long forum and evaluating the proof-of-concept version of the project at the end Summer Session I; we also imagined that the Research Forum fellows would continue to guide students during the "Entrepreneur Incubator" period in readying individual projects for market. We also realized that if we were, indeed, going to build an entrepreneur culture in the region, we would have to provide an incubator component to provide the initial infrastructure needed to be successful. Thus, we sought out and found collaborators in the College of Business who agreed to oversee this component of the project. We also invited MESA (Mathematics Engineering Science Achievement), an organization that promotes STEM (Science, Technology, Engineering, Mathematics) education to underrepresented students in grades K-12, to work with us so that our students would themselves become mentors and, ultimately, seed future participants in MTRI. Finally, we imagined an Equity Participation approach to the overall structure, meaning that projects generating from Entrepreneur Incubator would contribute a percentage of profit to MTRI to aid the program in becoming self-sustaining. With this structure in mind, we began to shop the project to potential funders. All in all, we conceptualized MTRI as a broad, collaborative, visionary initiative that would require a lot of support.

Unfortunately, fall 2010 was a difficult time to raise money in our region. Few businesses or individuals had extra funds to donate to nonprofits since they themselves were fighting for survival. Clark County, where the university is located, lost approximately 3,600 jobs in 2010, and the unemployment rate rose two percentage points, taking the rate to a high of 14.8 percent ("We're Still Hurting"). Median income dropped six percent during the economic downturn ("Median Household Income"). At the same time, tuition at state institutions was rising as the economy was falling. Tuition for WSU students had gone up a total of 26 percent in two years, making it even more challenging for our students to attend school and more necessary for us to find scholarships for them. From October 2010 to March 2011, we spoke to community and government leaders about funding but to no avail. Hearing about our idea through our tech support manager, Aaron May, however, the owners of Dick Hannah Dealerships stepped in and donated close to $68,000 for the "Coursework" component of the MTRI project. This donation provided 10 students with the opportunity to become "MTRI Fellows" and to receive tuition funding for a full summer, amounting to over $6,000 per student. The donation also covered the cost of students' books, course fees, and field trips associated with the MTRI project. Faculty decided that students would make two apps during the project: the first would be a free customer care app for the Dick Hannah company; the second would be an app for a local nonprofit arts organization. Faculty continued to look for funding for the other three areas of our plan, but by April we realized that we would have to concentrate solely on teaching app design and development, leaving the research questions for us to wrestle with among ourselves and the incubation of future app development businesses to our program to nurture.

As faculty were developing a large-scale vision of the MTRI plan, it also was working to develop the intellectual infrastructure needed to implement it — that is, the curriculum to include in the project, faculty to teach the curriculum, and students able to meet the challenges that advanced design and development brings. Because creating apps entails front end design, back-end coding, testing, and content development, it was obvious at the outset that it would not be one course needed to teach mobile app design and development but *four*. Luckily, our program has these courses already in inventory, and faculty able to teach them each semester. But in order to teach students how to create mobile apps, even with these courses already available to us, we faced two challenges: First, we knew that it would be hard, if not impossible, to put these four courses together in a special cluster of intensive study, and then ask faculty to commit an entire summer of teaching and learning, and require students to take a full load of classes during both summer sessions; second, our courses had been originally conceptualized for desktop web environments and, so, some of us had never taught mobile app design and development and did not know exactly what resources were available or how to do it.

The courses we identified as the four to teach in a mobile app design and development cluster were: DTC 336 "Design and Composition," DTC 478 "Usability and Interface Design," DTC 477 "Advanced Multimedia Authoring," and DTC 338 "Special Topics in Digital Technology & Culture." None of these courses are found in the required core for the major but, instead, are electives students can choose to take as part of the B.A in Digital Technology & Culture. The fact that these courses function as options for students gave us freedom to reconceptualize them so that they would provide a good understanding of theories and methods of design techniques, testing, special multimedia features, and the various languages needed for both Apple and Android apps. Additionally, DTC 477 and DTC 478 require the prerequisite course, DTC 355 "Multimedia Authoring," meaning that students involved in the MTRI project and taking this course cluster would have already learned HTML5 and CSS3 and had already produced multimedia content for the web. The DTC 338 "Special Topics" designation allows us to teach a variety of subject matter and made it possible to orient the class toward "The Development of Apps for iPhones and Androids" for the summer cluster.

We grouped the courses in two pairs, one for each summer session. This meant that each half of the project would last six weeks and that we had exactly 12 weeks to teach how to make apps *and* actually make two of them. It seemed to us that the first summer session should focus on design and the second on development. Pragmatically, we envisioned students learning about design requirements, including app aesthetics and Apple and Android design protocols, as well as content planning, so that at the end of the first summer session, students would complete a prototype and wireframe and produce a design standard for their apps. The second session would see these same students continue with the project by coding the apps and adding content to them. Faculty weighed in on the course curriculum and course schedule, developing the program into a cohesive summer study that involved this structure:

Summer I: May 9-June 17, 2011

DTC 336 "Design and Composition"
Professor: Dr. Dene Grigar; MW 11-2:20, VMMC 111
This course focuses on layout and design techniques, like color, alignment, balance, etc., for mobile sites and apps and helps students to problem-solve design challenges.

DTC 478 "Usability and Interface Design"
Professor: Dr. John Barber; TTH 2:30-5:50, VMMC 111
In this course, students learn to design effective interfaces for mobile sites and assess their uses.

Summer II: June 20-July 29, 2011
DTC 477 "Advanced Multimedia Authoring"
Professor: Will Luers; TTH 2:30-5:30, VMMC 111
This course is designed to teach students how to work with images, text, video, sound, and other digital objects for mobile sites.

DTC 338.01 "Special Topics: App Development for iPhones and Androids"
Professors: Nicholas Schiller and Nicholas Hill; MW 11-2:20, VMMC 111
This is a special topics course aimed at teaching students the programming for iPhone and Android development.

Faculty understood that the commitment to teach in MTRI assumed with it a commitment to retool ourselves, essentially becoming learners alongside our students. The challenge, however, was not an interest in expanding our knowledge into the mobile medium and learning all aspects of creating for the mobile medium; rather, as mentioned previously, it was undertaking such an exploration during an entire summer when we normally would be working on individual research projects. But we recognized quickly the benefits that MTRI could offer us. It is worth mentioning at this juncture that, as a faculty, we have adopted "action research," as one of our main research methods. Action research is a "systematic enquiry conducted though the medium of practical action, calculated to devise or test new, or newly imported, information, ideas, forms, or procedures and to generate communicable knowledge." It offers three different approaches (Research into/about Design, Research for Design, and Research through Design) and suggests "that practice and research [can] establish an effective liaison under specific circumstances" (Vannotti 51-60). Put simply, action research allows us to put design at the center of our research and suggests that mobile apps are not merely things we study but rather the reason for our exploration. Our work with MTRI has led to an invitation for all of us to teach at a Digital Humanities Summer Institute in Victoria, Canada in 2012 and publish articles and give presentations on methodology, pedagogy, and development in academic journals and conferences, respectively.

But while faculty were in agreement that MTRI would be worthwhile to pursue for both our research and teaching, we still needed to develop an incentive for convincing students, who generally need to work full-time in the summer in order to attend the

university in the fall and spring, that spending the summer going to school all day every day for 12 weeks would be beneficial to them. Scholarships helped to make our case.

As mentioned previously, Dick Hannah Dealerships donated close to $68,000 for the "Coursework" component of the MTRI project, enough money for 10 students to receive funding for full summer tuition, books, course fees, and field trips. The faculty organized the project so that we would grant this funding to 10 *top* students in the program and, thereby, provide summer "fellowships" to these students. They would, in effect, become "MTRI Fellows," and the fellowship would serve as an honor as well as an incentive. It is important to emphasize that even in the best economic times, Southwest Washington is not a wealthy area, and a high percentage of our students are first-generation college students. This understanding means that all students are "needs-based students" and, so, "excellence" figured as the main criteria faculty used for selecting students for MTRI. We drew from our courses those students who produced the best work in multimedia design, coding, content development, and project management/teamwork. Out of the 175 undergraduates in our program, faculty issued invitations to 10 to join MTRI. All accepted. We also decided to invite a faculty member on leave from the University of Southern California to join us—as a post-doctoral fellow—and a staff member to assist as well—as a post-baccalaureate—as a way of stimulating deep discussions of mobile theory and developing potential new instructors and consultants within our program. Other staff members and additional faculty joined us, too, due to the high interest in learning about mobile media. The incentive to learn mobile app design and development, to be chosen for a select group from among peers, and/or to receive full funding for an entire semester of coursework resulted in a dynamic learning community.

Figure 2. MTRI Fellows and Faculty

In the fall of 2010, when we began planning for MTRI, no textbooks existed that directly addressed the mobile medium. More than a year later, the first few academic books on this subject emerged, including Jason Farman's *Mobile Interface Theory*, and Jo Groebel, Eli Noam, and Valerie Feldmann's *Mobile Media: Content and Services for Wireless Communication*. What source material faculty did have access to while planning for MTRI, though, were non-academic resources on mobile app design and development that offered a commercial perspective. Our literature review turned up books such as Robert Hoekman's *Designing the Obvious*, Ken Yarmosh's *App Savvy*, Steve Krug's *Don't*

Make Me Think, Cameron Moll's *Mobile Web Design*, Jonathan Stark's *iPhone Apps*, Vandad Nahavandipoor's *iOS4 Programming Cookbook*, and Josh Clark's *Tapworthy*. We adopted these and included others that we had used in our courses, such as Dan Cederholm's *CSS3 for Designers*, Jeremy Keith's *HTML for Designers*, and James Bennett's *Design Fundamentals for New Media*. But knowledge gaps still existed not even addressed in articles and essays that we found.

One illustrative example of such a gap that Grigar confronted in DTC 336 "Design and Composition" focused on app aesthetics. The truth of the matter is that there is really not much in the way of good material to use for teaching aesthetics for web-based multimedia design and development, so it was not surprising to any of us that nothing yet existed on this subject for apps. Commercial publications center primarily on usability—how apps work for users, how users navigate information, and how they interact physically with the interface or computing device. Missing are discussions of the ways in which color functions in mobile environments, the fact that texture is essentially useless in environments where such little real estate is available, and that shape provides a strong focus for getting across concepts, style, and message. Put simply, Grigar had to figure out for herself that, despite what may seem a direct parallel, apps are not miniature works of art but, rather, something else. And the aesthetic underlying that "something else" had to be learned by thinking about the affordances and constraints of the mobile environment and getting her hands dirty making apps. To do this, she had to realize that her course material was essentially provisional (thus, be willing to make mistakes in class, since learning about apps was taking place while she was teaching it). These experiences mirrored earlier design and redesign efforts on the project she and Oppegaard were involved in—the Fort Vancouver Mobile project—in which best-practice benchmarks were first established in the workshop but, then, improved and refined through implementation and testing in the field as a generative and iterative process.

Part 2: What We Taught (and Learned Along the Way)

Teaching app development requires bringing together a set of tools and practices that are still in evolution. Every few months, new software arrives to challenge existing methodologies. Undoubtedly, by the time these words are published, certain obstacles will have been overcome by upgrades to existing software, or a new software package, such as Apple's "iBook Author," will alter the current market of interactive products. The challenge for educators is to find functional tools that students can learn relatively quickly so that the work in the class can go directly into the conceptual, practical, and collaborative aspects of app design.

As mentioned, the courses in the MTRI project were organized into two summer sessions with design as the main theme of the first, and development of the second. Thus, DTC 336 "Design and Composition" and DTC 478 "Usability and Interface Design" were followed by DTC 477 "Advanced Multimedia Authoring" and DTC 338 "Special Topics: App Development for iPhones and Androids."

DTC 336 "Design and Composition," according to the university catalog, teaches "design practices and processes for composition for a multimedia environment, including color, pattern, and shape." This broad view lends itself well for designing for mobile environments. Because all courses in the CMDC Program combine both theory and practice, students in DTC 336 read about concepts underlying design and composition for multimedia digital environments and produce work using PhotoShop, Illustrator, GarageBand, Audacity, iMovie, and Final Cut. The MTRI project built upon this established approach and asked students to produce the prototype for a mobile app, including its wireframe, which would be developed with content and coded during summer II, so that it would be ready for delivery in mid-August. Assessment was based on four activities: The design and composition of the App Prototype, which was worth 50 percent of the overall grade for the course; a Design Report, that explains the approaches and processes used to produce their prototype, worth 20 percent of the overall grade; an Oral Presentation to the client (Dick Hannah company stakeholders), an activity worth 20 percent of the overall grade; and a Reflection Paper, that asked students to think about the work they undertook in the course and write about what they learned about design and composition and themselves as multimedia designers, an activity worth 10 percent of the overall grade.

We used three books for the course: *App Savvy* by Ken Yarmosh, *Designing the Obvious* by Robert Hoekman, and *Design Fundamentals for New Media* by James Gordon Bennett. The first two address approaches students need to know for multimedia design: user-centered design, iterative design, and rapid-prototyping; thus, they were helpful in providing a general notion of creating apps and design, respectively. The third, *Design Fundamentals for New Media* by James Gordon Bennett, provided students with basic information about multimedia design based on desktop environments. As mentioned previously, no text to date focuses on app aesthetics. So, we also read essays and chapters on web and app design by Lyndon Cerejo, Jurgen Schieble, Bill Moggridge, and Abhijit Kadle. Guest speakers involved in app development in the Portland-Vancouver metropolitan area included Frank Mungeam from the KGW news agency and Reed Rotondo from Pixel River, a local design firm. Mungeam remained with us as a consultant on the MTRI project since he had experience with taking apps to market. Students researched apps in the iTunes App Store and in the Android Market to get a handle on best practices and read reviews about apps on various online sites.

All activities in the course centered on teaching students to think through design principles that correlate to mobile apps and, then, to apply those principles for creating the prototype and wireframe. This approach meant that we had to consult the development guidelines for Apple (and later Android) to understand the requirements from the launcher icon and common screens, such as the splash and landing screens; know what kind of information is allowable on menu and navigation bars; and develop an appreciation for producing images, texts, videos, and slide shows for small screens. Students found Illustrator helpful for prototyping because it allowed them to scale images to the sizes they needed easily, and they used PhotoShop for producing the wireframe.

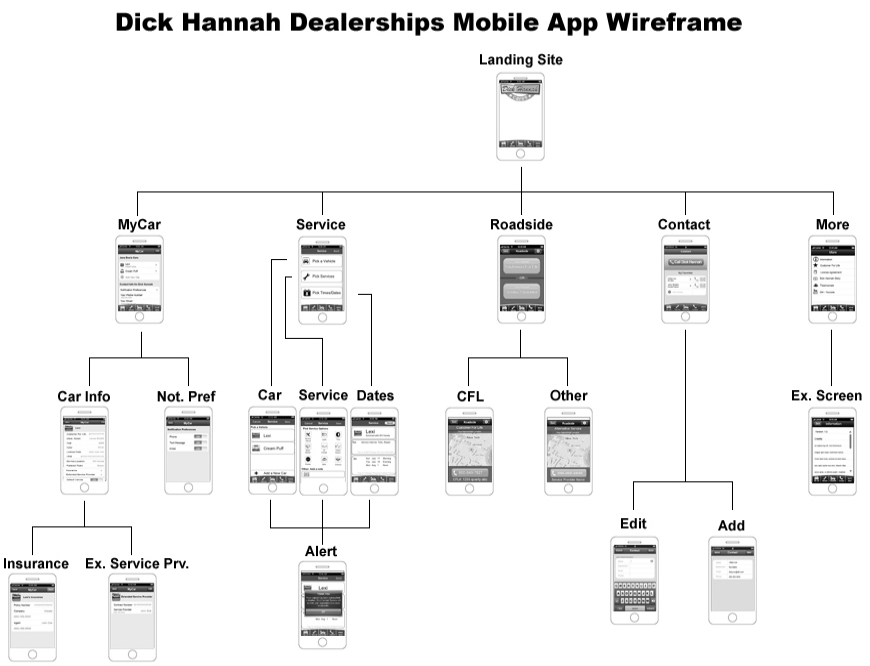

Figure 3. Wireframe for the Dick Hannah App

As the class came to a close, faculty developed a list of qualities for app design that they knew can be applied to future courses, and students had produced the prototype and wireframe for their app. (See Fig. 3).

DTC 478 "Usability and Interface Design" focuses on the overlay of design, content, users, and situation in order to promote efficient and effective utilization of desktop and mobile interfaces for various media objects. In this course, interfaces are seen as portals between a variety of users in a similar situation and collections of digital data or information. Students in this course conceptualize, critique, analyze, evaluate, and produce usable interfaces for various digital media devices. Because usability and interface design is the study of how we design, build, and then actually use digital interfaces, the desired outcome is the smooth and easy use of such interfaces. It is about assuring that what we build works as intended and in the situation in which it is utilized. So, the nature and extent of situation-centered design, and of usability built into interfaces, derives from the understanding why someone will use an interface and for what purpose. This approach provides the course direction, follows the "learn, think, build" focus of The CMDC Program, and addresses specific research questions for this course.

- (LEARN) How do users (ourselves included) respond to interfaces and their design?
- (THINK) What does "usable" mean and how do we assess the usability of interfaces?
- (BUILD) How do we assure usability throughout the design and building process?

As noted previously, because much of app development has evolved from commercial and "DIY" sensibility, teaching app design and development, and by extension usability and interface design, is not yet common or standardized in academic institutions. We felt the need to develop, for the MTRI project, an approach that sought best practices of unique app affordances, interface usability, and user experience. Using our course texts, Robert Hoekman's *Designing the Obvious*, Ken Yarmosh's *App Savvy*, Steve Krug's *Don't Make Me Think*, and Cameron Moll's *Mobile Web Design*, we set goals for our endeavor:

- Conceptualize the mobile environment and its affordances in relation to our project. Specifically, we needed a quick, general overview of the mobile environment, insight into the differences between apps and mobile-based websites, knowledge of the spatial considerations for smart phone and tablets, and an understanding of how all these factors affected usability and user experience.
- Develop information architecture and usability for our mobile project. We needed to understand how developing information architecture for mobile projects may be different from web-based ones. Specifically, we needed to be able to develop the information structure for our mobile project.
- Produce, rapidly and repeatedly, robust wireframes and prototypes for our mobile project through which we could gain a better understanding of how working with text, images, video, sound, and other digital content would be different in mobile environments than web-based. Specificiallly, we needed to understand any limitations and apply best practices associated with the development and utilization of multimedia content for our mobile project.
- Understand the coding and programming requirements for mobile devices and how these factors might affect usability and interface design. Various code languages and platforms would be utilized and we needed to have a good idea of how they would influence and determine the production methodology for our mobile project. Specifically, we needed to know what resources we needed to complete our work.

We achieved these goals as follows. First, we meet with Dick Hannah stakeholders in order to determine their desires and considerations for the desired app, along with their thoughts regarding the purpose for its creation and utilization. Our focus in this first meeting was "WHY build this app?" The answer came in several guises: provide customer-dealer contact, promote customer-dealer relationship, augment existing customer services, provide new level of services, provide information management, and provide customer resources. The common theme among these reasons was information and its flow between Dick Hannah Dealerships and its customers. Discovering this theme allowed us to think about how to organize information in convenient and logical groupings, or, as we called them, "information buckets," in order to enhance its usability. This information organization would, we felt, surely change as the project evolved, but from the start we would have a sense of the app's underlying information architecture and how this might drive navigation.

Next, we considered the question, "How will this app accomplish its purpose?" The answers included a number of suggested resources, which, after preliminary scaling,

changes, and combinations, produced a manageable top-level directory of the resources offered by the app. From this point, we were able to conceive an interface that was smaller, more concise, while affording room for resource expansion under each of these top-level headings. These resource headings might, we felt, translate into navigation buttons at the top level of the interface. Selecting specific buttons would allow users to interact and relate with the app in a number of significant and important ways. For example, selecting the “Service” button might provide users the ability to schedule an appointment, to read recall information or service messages, to connect with the Collision Center, or the Parts Department. Understanding the potential organizational structure for information resources afforded by our proposed app, we began planning for its implementation. We did this through rapid iteration using wireframes and prototypes.

Wireframes are quick visualizations of individual screens. They show only the potential placement and organization of elements, not the visual design, content, or interactivity of the app. We created wireframes on a whiteboard, each member of the team augmenting or changing what someone else had produced. Multiple iterations were, thus, easily created in immediate response to ongoing discussions between the design and development teams, and sometimes with other project stakeholders. At the end of each session, we captured our work photographically. Using these photographs, we created more robust and detailed wireframes which became the genesis of our next session discussions. The photographs were preserved in our project archives.

Once the wireframes were stabilized, we moved to the rapid iteration of prototypes, or visualizations of all the screens associated with the mobile app. Prototypes can show not only placement of elements, as do wireframes, but the type (text, image, etc.) and extent of each element, what interactivity it affords, and which screen is the result of any action. Again, we began with collaboration at the whiteboard, moving from there to paper prototypes produced by individuals or teams taking ownership of specific aspects of the proposed app. Using paper prototypes, we could develop task scenarios for usability testing. This approach to usability, we felt, provided increased opportunities for the pervasive examination of our project to identify problems and/or errors. It was easier, and less expensive, we reasoned, to fix problems on paper than it would be once we started coding the app.

In agreement as to the information architecture, and the navigation structure that provided the best support and access, we were ready to code and develop the app. The robust wireframes and prototypes developed through the collaborative efforts that took place in both courses in the first summer session served as blueprints for the building, ultimately saving time and effort. By working to achieve usability first and foremost, we were able to determine what features and affordances were necessary, and which were desirable, even "cool," but not necessary to the functionality of the app and its achievement of a specific purpose. When it came time to turn the project over to the coders and developers, we knew exactly what to build, what features and affordances were required, and how the various parts of the app were designed to work together. Like the developers, the visual designers also had a blueprint, complete with style guides, color

palettes, and content strategies. Team members not designing or developing worked to provide the necessary content. Again, they had a clear set of directions to follow. No time was wasted determining what content to procure or produce. We had answered these questions during our rapid iterations sessions. Each member of our team knew what needed to be done, and why, in order to assure the most satisfactory user experience, and the highest level of usability. For all these reasons, our return on investment was far more rewarding than if we had begun straight away with building of the app.

DTC 477 "Advanced Multimedia Authoring" focused on teaching students how to utilize HTML5 and CSS3 for the production of native apps. At the time of this writing, the most common method of creating a native mobile app was to use the particular mobile device's own development tools. The free iOS and Android SDKs (software development kits) include simulator tools for target devices and contain extensive support resources. However, the programming languages for each SDK are unique. Apple uses Objective C, and Android uses Java. These are not widely used coding languages and require a steep learning curve, especially for students with little background in programming trying to learn to make apps in 12 weeks.

Another method, and the one adopted for MTRI, was to use standard web tools (HTML5, CSS3 and Javascript) to build a web-app with mobile-like navigation and, then, package the files into a native app for distribution. PhoneGap, an open-source mobile app framework with an active community of developers, works with a variety of SDKs to package native apps written as web files. PhoneGap can access unique device APIs, such as the camera and geolocation hardware functions, and it also fits the requirements for distribution to either the Apple or Android markets, following their distinct specifications.

As mentioned previously, MTRI students had all taken the introductory class DTC 355 "Multimedia Authoring," in which they learned the basics of HTML, CSS and Javascript as well as Photoshop and Illustrator. In the first classes of DTC 477 "Advanced Multimedia Authoring," selected as one of the courses in the MTRI cluster, some time was spent introducing new features of HTML5 and CSS3, especially focusing on how these features work with Javascript. For example, they learned to use "media queries" to change CSS layout between landscape and portrait modes, accessing Javascript and jQuery plugins for controlling touch navigation, and using the Google Maps API for acquiring the user's geolocation.

The first assignment in DTC 477 was to build a one-page web-app (a mobile website) that was responsive to different device orientations and widths. In the assignment, called *Place Portrait,* students compiled information—text, interactive maps, images, video and/or audio—about a favorite place anywhere in the world. Students, then, were given a template that demonstrated the new HTML5 features for mobile design and were allowed to play at arranging layouts of media elements while becoming conscious of the particular constraints of mobile design. This activity was intended to provide students

the opportunity to explore technologies and concepts needed for the larger project that loomed.

We chose to develop the MTRI app using a comprehensive mobile framework that worked well with the specifications of the client. Although there was initial resistance to this approach (it was perceived to be too limited), students came to appreciate the flexibility and ease with which they could build pages that share common styles and behaviors. The jQuery Mobile Framework made formatting, touch events, and transitions quite intuitive, but it still required a basic understanding of Javascript and jQuery. To introduce principles of programming and computational thinking, students built simple games using free online software from MIT. Scratch, for example, is a graphically based game-creator in which one makes objects animate and respond to user interactivity. The software is easy to learn but quickly demonstrates that programming is a thinking process. For non-programmers, an important principle to understand is that good programming begins as a way of thinking—not the mastery of a particular computer language.

After being introduced to the principles of programming in a play environment, students were immersed in the basic syntax of Javascript and Javascript libraries, specifically jQuery. They could, then, see the familiar graphic code blocks in Scratch translated as lines of computer code. Through short practical exercises, students developed an understanding of Javascript and how it works with elements on a web page. Of course, some students picked up the programming skills more quickly than others and could take on more challenges, but all students were required to attain a certain proficiency so they could think about the app they were making with the proper depth. After learning the basic syntax of Javascript and jQuery, students were introduced to the jQuery Mobile Framework. Flexible and functional, the framework allowed students to immediately apply touch events, pagination, and transitions without needing to write code. It helped that they understood how it all worked, especially when it became necessary to alter the template. Writing code for certain app functions, such as showing geolocation on a map, or capturing and storing form inputs, was left to those students who showed an aptitude and desire to jump into programming at a deeper level.

Once the HTML5 pages were tested and working with the various Javascript and jQuery libraries, all files were imported into Apple's SDK: Xcode. In its first stage of development, the Dick Hannah Customer Care app was tested using Xcode and its iPhone simulator. When version 1.0 was ready, students and faculty discovered Apple's process of licencing, testing and submission was more complicated than anticipated. Submitting updates to Apple, however, was quite simple. An Android version was also submitted later without much difficulty.

DTC 338 "Special Topics: App Development for iPhones and Androids," as noted earlier, allowed us to package and teach specific subject matter and orient the class toward a specific goal: successful completion of the app. In this course, the emphasis was on programming necessary for successful app development and deployment and so we felt it

most productive to link this class closely with the concurrent DTC 477 "Advanced Multimedia Authoring" course. Essentially, DTC 338 became a laboratory for DTC 477, a context in which students could, following our guiding principles of action research, learn to build by putting into practice a developing body of knowledge and ability. Most of these class sessions were devoted to collaborative problem solving and/or focused development research. As discussed below, this course was co-taught by a recent CMDC graduate with professional-level programming skills, thus allowing faculty and students the opportunity to learn from theoretical as well as practical, applied perspectives.

Part 3: Theory, Practice, and the Real-World Experience

We designed our pedagogy for teaching mobile app development to include practical and applied perspectives, not because theoretical pickings on this subject are thin but rather because directing students to focus on situated material and particular practices of particular people in particular places, in the "here and now," constitutes a dynamic action-research ethic. That ethic aims to demonstrate that deep understanding comes from clear awareness of social and educational practices *in situ*. Such a focus means the emphasis for student interpretations are drawn from the product of the specific material, social, and historical circumstances that produced the practices, and by which, they are reproduced regularly through social interaction in the particular setting (Kemmis & McTaggart, 2005, pp. 277-279).

Action research meanwhile incorporates both qualitative and quantitative approaches, based on the needs of the particular research situations, because qualitative data is due to change when circumstances change, and quantitative data serves only as a crude approximation of the ways in which participants understand themselves. Action researchers, from this viewpoint, therefore try to understand practice from its individual and social aspects, as well as objectively and subjectively, and as constructed and reconstructed historically both in the terms of the discourses and in terms of those constructed actions and consequences. If open to construction, then these research methods must also be open to reconstruction, and extend beyond the realm of preformed solutions, including the potential for borrowing and remixing, such as applying and adjusting established desktop computing ideals to mobile environments, in an effort to bring new light to the nature, processes, and consequences of the particular object of study (pp. 290-293). The action research mantra established by Orlando Fals Borda (1979), then, is to: "investigate reality in order to transform it" and transform reality in order to investigate it (qtd. in Kemmis, 2006, p. 470). This interpretive perspective, from which action research generates, acknowledges the researcher as an insider, as a part of the fabric of the inquiry, and an indivisible element of the environment within which people, including the researcher, are interacting (McNiff & Whitehead, 2006, p. 10).

Researchers traditionally tend to try to distance themselves from their work, as if such separation somehow distinguishes the results as "more plausible, credible, perhaps even more 'scientific'" (Burnaford, Fischer, et al., 2001, p. 7). Kurt Lewin (1948), though, contends that the person stands at the center of his or her life space and that an understanding of that life only can be accomplished by beginning with the perspective of

that individual. Put into a research context, that the researcher starts exactly where he or she is, and then tries to *do* something. Knowledge, in turn, can be created from problem solving in real-life situations (Herr & Anderson, 2005, p. 11). Such a personal emphasis on knowledge building was reinforced by Jean Piaget, Howard Gardner, and John Dewey, who wrote (1985, p. 39): "The discovery is never made; it is always making" (qtd. in Burnaford, 2001, p. 8-11).

Students in the MTRI program, as in all CMDC courses, consistently combined talk about theory and abstract conceptualizations with complementary hands-on application of those ideas and experimentation that exposed numerous gaps in the scholarly knowledge about mobile app design. While supporting creative freedom and innovation in research, such an action-based approach also builds practical skills and valuable project-management experiences. In the process of reading about—and theorizing about—building mobile apps, our students also made practical gains in skills related to writing, editing, design, photography, videography, collaboration, team coordination, public relations, marketing, and technical manipulations of various computer and Internet technologies. Core action research goals, therefore, include improving practice and developing individuals but also transforming practice as well as participants (Herr & Anderson, 2005, p. 9). As Thomas and Brown point out, "When we build, we do more than create content" . . . we also create context by building within a particular environment, often providing links or creating connections and juxtapositions to give meaning to content." They add, "By participating in the making of meaning, we also learn how to judge and evaluate it, giving special sensitivity to the ways information can be shaped, positively as well as negatively" (2011, p. 94-6). During such a process, the creator transcends "from experience to embodiment, where the personal investment in technology and digital media changes the focus from social agency to personal agency. When that happens, technology and digital media begin to be viewed as an extension of oneself" (p. 103). Learning, therefore, becomes an integrated part of humanity, rather than just something a person happens to do at school.

Part 4: Needed Resources

The site of this extension between technology and our human selves (i.e. the primary learning environment for MTRI students and faculty) was The CMDC Program's multimedia lab. This space is equipped with 25 Apple iMacs and six Mac Pros. The students' iMacs are arranged in six pods of four to encourage group work and peer assistance. All of the iMacs are set up with identical hardware (21.5", Mid-2010, 32.Ghz Intel Core i3 processor, 8GB Ram, 1TB HD) and software packages to ensure students have the flexibility to work on their apps at any machine.

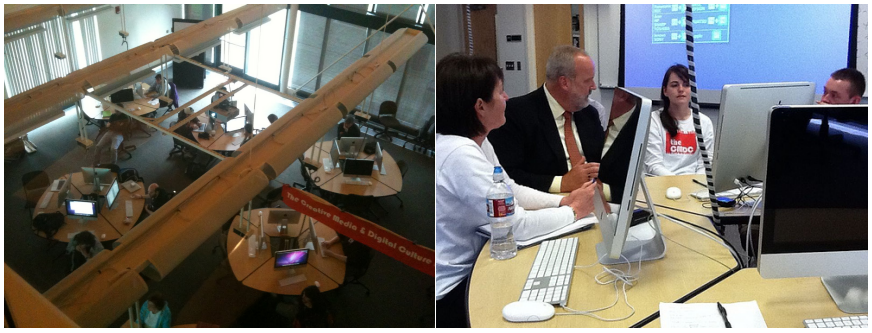

Figure 4. The CMDC Program's Classroom Layout & Its Use for Collaborating

Our lab already owned some of the programs needed for MTRI, including image editors, web browsers, and text editors. However, it was necessary to install new software items for the purposes of app development and testing. It should be noted that installing software requires administrative access to the destination computers and may require the assistance of one's IT department's personnel.

To prepare the lab, we first made sure we were using the current version of the Mac operating system, which at the time was OS X v10.6 "Snow Leopard." Then, we installed the Apple iOS Developer Tools, including the Xcode application. For Android app development, we installed the Eclipse developer environment and Android SDK. Then, we set up the Android Development Tools (ADT) Plugin for Eclipse, which provides easy access to the Android SDK. Finally, we installed the PhoneGap mobile framework, which allowed us to wrap HTML5 web apps in platform-specific containers for distribution to the Apple App Store and Android Market. All of these programs have associated websites with clear instructions on how to download, install, and configure the software.

App Development Programs

Apple iOS Developer Tools
https://developer.apple.com

Eclipse
https://www.eclipse.org

Android SDK
http://developer.android.com/sdk

ADT Plugin for Eclipse
http://developer.android.com/sdk/eclipse-adt.html#installing

Phone Gap
http://phonegap.com

Figure 5. App Development Programs Used in MTRI

The Apple iPhone was first released in 2007 and has undergone four major revisions since that time; therefore, it is important to stay abreast of software and hardware upgrades and to test on every iteration of the phone available. This means that faculty

interested in teaching app design and development should have access to a selection of mobile devices for prototype testing. Although the developer tools do include simulators for iPhone, Android, and iPad screen sizes, there is nothing quite like being able to view, touch, swipe, and pinch your budding app on the actual devices your audience will be using. An app may run smoothly on a new iPhone 4S, but it may not perform on an older 3G model. It may look fine on a phone-sized screen, but not layout effectively on a tablet. The MTRI program, understanding the need for access to these tools, purchased two iPads for the project with the MTRI donation. Faculty and students also personally owned a wide variety of devices, which allowed most of us to have access to testing our apps.

Part 5: Faculty as Learners

Most of the faculty who participated in the MTRI attended other classes in the sequence throughout the summer. This gave us a unique perspective as observers/learners as well as participants, and a few of these observations are worth noting here.

First, having faculty attend the classes sends a powerful message to the students in the program. When a professor stops the routine of their research time in the summer to extend their skill sets, s/he leads by example. Since MTRI is an interdisciplinary program, having faculty involved in this capacity helped to reinforce the respect that each have for one another and their respective areas of study. This sensibility adds to the culture of innovation—that is, learning does not stop at pre-determined boundaries. With every class having at least one other professor attending, faculty embodied the phrase that has peppered many teaching philosophies over the past few decades: lifetime learning. Students see professors sitting in classes learning for the sake of learning, rather than as a necessary step to an endpoint. This also helps to establish a culture in which students value the opportunity to learn. For example, following MTRI we offered several short series of workshops on technologies such as PHP, MYSql, and WordPress that did not count for credit but filled up quickly, nonetheless.

Second, it required a different set of expectations for teaching. Every faculty member in the four-course sequence taught a subject he or she had long taught but had to revamp it for the mobile environment. The syllabi served more as guides, and less as contracts, and faculty adjusted expectations and assignments as needed. Coupled with the summer-long app project, this approach entailed a certain vulnerability—the teachers did not always know everything in the mobile environment, and they did not hide this fact from the students. Here, the culture of "everyone as learners" fostered a positive climate. Rather than giving answers, the approach involved peeling back the curtain. Students were brought into the world of learning and discovery alongside faculty. Students learned how to find further information through DIY and crowd-sourcing methods and were given the tools to research answers, much in the way faculty teach themselves. Once the opening lecture material was presented, learning became viral. Within each class, as students completed activities, they roamed the room helping both fellow students and faculty who had missed something in the code, or were otherwise having some trouble successfully completing the activity. This approach spread until everyone had completed

the assignment; it worked more efficiently than one faculty member roaming around trying to help a roomful of students at once. One salient example of the success of this approach focuses on one of the MTRI Fellows who was selected for her project management and content specialist skills. Though she had never taken well to coding in her previous courses, she became competent in Objective C and revelled in her ability to assist other students who considered themselves great coders. She emerged as the natural teacher among the MTRI Fellows, and because all students were potentially vulnerable, no one person felt outside the parameters to learn.

One course, DTC 338 "Special Topics: App Development for iPhones and Androids," was co-taught by a recent graduate with professional-level programming skills. Involving an alum, as we did in MTRI, allowed students to learn and, then, return to share their knowledge with us. Perhaps not every professor would feel comfortable doing this, but in keeping with crowd-sourcing and participatory learning models that The CMDC Program embraces, we found it to be a remarkably satisfying experience to attend a class taught by a former undergraduate who had been in our classes just the previous year. Given that the current generation of students is, perhaps, the first to teach its own parents life skills generated by new technologies (Tapscott), this mode of learning makes sense to explore in our college classrooms.

Finally, two other factors helped make this sequence and project successful. Beyond the faculty having a certain level of comfort with ambiguity, the project needed students who could handle this environment. Having the opportunity to select students for the classes enabled us to cull a strong cohort. Simply put, the project would have failed had the students not been up for the challenge. Their willingness to put in the necessary work to learn, think, and ultimately build (an app in this case) entailed the most crucial aspect of the project. Like the faculty, they needed to be flexible and committed. Although these two qualities are vital for the post-college world, many college courses are so tightly controlled that students' problem solving skills become secondary, or they simply exist within the confines of a paper. A group of students with the focus of "exactly what do we have to do to get an A" would not have worked.

The summer school format allowed for intensive sessions and gave students the opportunity to focus on one project. We did detect at the start of the second summer session a bit of fatigue in the students, having gone straight in from the spring to summer semester without a break. Interestingly, though, the fatigue quickly dissipated once the coding started and they began to see the fruits of their labor in an app that worked.

Conclusion

The end result of the MTRI project was the design and development of two apps, with the main focus on the Dick Hannah Customer Care app now found in the Apple App Store and the Android Market. Our story, of course, does not end with the success we had with making apps in MTRI; rather, as we have intimated throughout this essay, it constitutes a new beginning: CMDC 2.0, so to speak. While we were not able to undertake the whole of our vision for the MTRI project, we did train a cohort of talented

students to make apps. The faculty did retool ourselves so that we now teach app design and development in all of our courses. We did help to provide funding for 10 students to attend classes during the summer and, so, be fast-tracked through their degree. We did develop a close partnership with a local business interested in investing in education. Following MTRI, we matriculated students into good jobs and graduate programs where they can utilize what they have learned because of these endeavors. Finally, we are still working with some of these students on another challenging project funded, again, by Dick Hannah Dealerships: an interactive, augmented reality installation, entitled "Autovation," for the Oregon Museum for Science and Industry. So, at the time of this writing, six of the MTRI Fellows who have not yet graduated from our program, along with four new students selected for this honor, are now engaged in the design and development of this project, and sitting at the heart of it are the very technologies we all had to learn for app design and development.

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Appendix 4:

Book chapter, accepted. "The Mobile Story: Narrative Practices with Locative Technologies," expected to be published by Routledge, in the fall of 2013

The Interrelationships of Mobile Storytelling

Merging the Physical and the Digital at a National Historic Site

Brett Oppegaard and Dene Grigar

Introduction

Paul Kane could sense a story that needed to be told. The self-taught painter, reared in Toronto around "hundreds of Indians," realized in the mid-1800s that the "noble savages" he had befriended as a child had essentially vanished from his region. Inspired to document aborigines before they were eradicated or assimilated in the rest of North America, Kane started exploring the Canadian frontiers and the ways in which he could tell this compelling tale. He used the mobile media of the period: paper and pencils as well as oil and watercolor paints. Those journeys eventually led him thousands of miles west into uncharted wilderness, where he drew sketches of chiefs, women, children, costumes, natural landscapes, and scenes depicting manners and customs of all sorts.[i] Kane then took those hundreds of drawings and detailed journals back with him to Toronto. He translated many of them into romanticized oil paintings. He hosted several popular exhibitions of the material. More than 150 years later, though, these irreplaceable interfaces into the past have become materially irrelevant: Kane's images and stories, extracted from their native homes, simply became disconnected from time and space. No longer tethered to a place, no longer new, the images and observations sunk back into their containers, drifted deeper into the library shelves, were placed into storage, then gradually faded from general concern and consciousness.

While that data has stagnated in a nether space, modern mobile devices—smartphones, tablet computers, portable technology of all sorts—have emerged with unprecedented power to reconnect worlds, recombine media, reconstruct images, recount observations, and reverse the alienation and separation epidemic of contemporary life. These devices also represent an opportunity to forage through our past, to find the stories, like Kane's, that matter and to give them relevance again. So swiftly is society shifting due to this technological innovation that wireless penetration in the United States surged from 34 percent to 93 percent during the past decade, with many American adults now carrying

around information-rich mobile devices. Meanwhile, wireless data revenue grew over that same period from $140 million to $47 billion.[ii] The epoch of pervasive media has begun, just as Kane in his time recognized the sudden ubiquity of European culture in wild northeast Canadian terrain. During Kane's life, Native Americans were almost annihilated; America fought in its deadliest conflict, the Civil War; colonialism, slavery, Manifest Destiny, and other monumental crises of humanity were experienced and debated in real time. While mobile stories need further examination in all forms—from fiction to nonfiction, from narrative to expositional, per the many examples in this book––the core of this chapter is inspired by George Santayana's prescient yet still widely unheeded mantra, "Those who cannot remember the past are condemned to repeat it."[iii]

Mobile devices undeniably are changing the ways in which we view the world. They are affecting our projections of tomorrow and our remembrances of yesterday. These new tools, in turn, are creating unprecedented opportunities for digital authors. When composing mobile stories, a creator now can know where his or her users are (location awareness), what is physically around those users (spatial awareness), and even what the users have been doing before the moment of connection, all while crunching data to predict what they likely will be doing afterward (contextual awareness). These devices can level out the hierarchy of composition between author and audience, as much as desired, creating the potential for a high level of collaboration and direct feedback to the story space. They also allow for creative expression by the audience to be incorporated into the content. These devices can even create tangible displays of social connectedness. In essence, mobile storytelling fosters interrelationships between four distinct entities—between content and medium; people and space and time; people and information; and people with other people. Mobile devices open new portals for rediscovering the forgotten yet illuminating stories of our shared history, including on the American frontier, like Kane's. This perspective has galvanized a team of academics, historians, archaeologists, curators, new media practitioners, and mobile developers who want to further explore this fertile mediascape. The collective effort, dubbed the "Fort Vancouver Mobile project [http://fortvancouvermobilesubrosa.blogspot.com/] [http://dtc-wsuv.org/wp/fvm/]," focuses on research into the field of mobile storytelling at a principal historical hub in the Pacific Northwest, the Fort Vancouver National Historic Site [http://www.nps.gov/fova/index.htm], where Kane spent the winter of 1847 and today more than 1 million people visit each year. This essay, then, looks at one aspect of its theoretical underpinning: the interrelationships made possible by digital media storytelling.

Ideas expressed in this essay are born out of the experiences of developing digital content and a mobile app at the historic site. Fort Vancouver originally served as the early end of the Oregon Trail, then later the regional headquarters of the British Hudson's Bay

Company's fur empire, a hub of a 700,000-square-mile dynasty called the "Columbia Department," located on the north bank of the Columbia River. Later, the site served as the first U.S. Army post in the Northwest. The Fort Vancouver National Historic Site is now home to 2 million artifacts, most of which are kept in warehouses. These archaeological items, gathered from more than 50 years of excavations, only begin to tell the story of the place, once dubbed the "New York of the Pacific." Countless other boxes of documents, drawings, and assorted historical records add to the complexity of this multicultural mosaic. Because of its vast and diverse history, the site is representative of a long and thick narrative spine, one that materializes as more of a richly detailed realm, stuffed with intriguing characters and plots, than a straightforward and narrow string of pearls. It is the kind of story that demands a medium capable of handling its many facets in a way that makes sense geographically, historically, and technologically. National Park Service [http://www.nps.gov/index.htm] staff members at the fort understand the potential that digital technology offers across those layers of experience and began, themselves, exploring options, such as on-demand podcasts and social media streams, as a way to augment traditional interpretation efforts like kiosks and printed materials. Yet the storytelling opportunities of a mobile app were thought to offer such a richer and deeper environment for site visitors that the Fort Vancouver Mobile team was formed to explore such melded space, mashing together the physical and the digital, while bringing together scholars and artists from Washington State University Vancouver, [http://www.vancouver.wsu.edu/] Texas Tech University [http://www.ttu.edu/], Portland State University [http://pdx.edu/] and the Center for Columbia River History [http://www.ccrh.org/] as well as regional experts in new media production to conduct experiments in the field. All of us sensed something special emerging, but one of the first tasks was to try to pinpoint exactly what that was.

The Affordances and Challenges of Mobile Media for Storytelling

The hand-held mobile phone has been around for 40 years, but its secondary use as a device for composing and distributing stories is relatively new. The first cell phone novel, *Deep Love*, [http://www.historyofinformation.com/expanded.php?id=2705] was created in 2003 in Japan, as a point of reference. Other forms of digital stories also have been emerging, with more recent examples drawing on the improved connectivity and robust features made possible by smart technologies. But as early as 2006, Henry Jenkins recognized that modern storytelling, in turn, had become more about world building, as evolving authors began to create compelling digital environments "that cannot be fully explored or exhausted within a single work or even a single medium" because only a world can support the next developmental phase of storytelling in which multiple characters and multiple stories cross into multiple media.[iv] The affordances for storytelling as "world building" means that Fort Vancouver can be told as a biography of

its founder, John McLoughlin, or from the perspective of any number of the characters who inhabited the place and later became important nationally and internationally, including Ulysses S. Grant, George C. Marshall, and O.O. Howard. Or it can be told from the viewpoint of any of the hundreds of uncelebrated and undocumented workers, or from the perspective of women who kept the semblance of Western civility, replete with Spode china, in the rough and ready frontier. The Fort Vancouver story can be set at the time of the founding of the fort, when the location was part of the Oregon Trail, or during its heyday, when the fort ruled the region as the hub of the Hudson's Bay Company's fur-trading empire, or afterward, when the U.S. Army pushed the Canadians north and created the first American military outpost in the region. Or it could show the time before the Europeans arrived, or even the moment of first contact, à la the settling of Jamestown. The same relatively small piece of land supported all of that narrative activity. Yet people generally come to Fort Vancouver today and want to learn "the" story. History, in this respect, is closer to art and literature than science. Tozzi references to the phrase "impositionalist narrativism" as a way to describe the coexistence of multiple interpretations of the same event, dependent upon the storyteller's perspective."[v] This idea presents a picture, of sorts, of the complex intertwining of the personalities and beliefs of the interface, or interpreter, with the individual and personalized interests of the user. The ultimate goal of mobile storytelling from this perspective is, then, as Lim and Aylett note, to provide ways for visitors to the site to navigate among this interconnected mass of information and gain access to free-choice learning.[vi]

Historic sites inherently attempt to connect story and place, for without that tether, they have no clearly recognizable spatial or physical purpose, and therefore the community has no logical reason to devote space and resources to maintain them. In Western culture, at least, such a place provides a tangible link to the past, and the historical storytelling makes explicit what is implicitly embedded in the local landscape.[vii] Such sites have incorporated various technologies to make such connections for as long as they have existed, and they continue to try to find new ways to make their stories relevant to new generations, including a wide range of techniques, including physical exhibitions, outdoor panels and audio tours.[viii] Despite such alluring affordances, mobile storytelling has been slow to attract architects of narrative realms. These essential producers, who place the portals and filter the noise, rarely are venturing yet into these types of interactive and immersive forms. With a few exceptions—such as Evan Young's *The Carrier [http://www.carriercomicbook.com/index.html]*,[ix] the *Tracking Agama* [http://jenstein.net/tracking-agama/] team,[x] and the Neighborhood Narratives [http://neighborhoodnarratives.net/] projects[xi]—it seems odd that arguably one of the most potentially powerful storytelling devices for connecting story and place instead has been relegated to the relatively narrow transmissions of text messages or as a platform for

puzzle games. Yet as this book testifies, those in the digital humanities and media art are beginning to realize the enormous potential of mobile devices as storytelling tools.

Technical issues right now make authoring in any mobile space a frustrating and time-consuming endeavor. These devices tend to have a highly restricted energy capacity, relatively low computing power, and relatively small amounts of memory and storage space, plus limited color and font support. The keyboards typically are small and hard to use, and limited bandwidth makes downloads typically slow, causing lag or even worse.[xii] Theoretically, mobile devices eventually will adapt universal standards and gain intuitive features and functionality. These standardizations will increase and allow for more complex presentations.[xiii] Improved technology, higher speed transfer rates, and more standardization eventually should solve many of the technical issues. Typical users of interactive technologies, though, tend to be less interested in the technologies themselves and more interested in the story or purpose of the interaction.[xiv] Blank pieces of paper, even in the dangerous wilderness, like Kane had, might even seem preferable at times. His worst technical glitch was more than likely a broken lead, and the toughest medial decision he had to make was pencil or paint. But the field of mobile storytelling cannot afford to wait this one out. There are no indications that such technological problems will be solved any time soon, and some of the significant theoretical issues within the field already are within reach.

Theoretical Underpinning: Intermediality and Its Interrelationships

When a broad society-changing technological advancement appears, as mobile "smart" phones have in the last few years, extremists typically are the first to measure in, offering polemic dystopian and utopian views about how life as we know it is ending, or a new era is beginning. Many of us may remember when digital writing (replete with hypertext linking) was introduced, Sven Birkerts lamented the end of wisdom and intellectual depth[xv] and Robert Coover predicted "the end of books."[xvi] Few technologies actually live up to these bold assertions. It takes full mainstream adoption and many years of exposure to a technology, after a general calming and settling, before a true calibration finally can take place. Only then, can we more clearly see what has changed us in significant ways, and what hasn't, as we emerge from the shroud of something different having taken place and having been adopted into society. This general understanding of knowledge stratification parallels and reflects the logic typically applied to the creation of academic theories and the herding of vast realms of decentralized—yet seemingly related—knowledge, such as "new media," into an orderly model, in which virtually every step, or new layer of thought, comes directly from, or is an extension of, another. Only today, the chaos of perpetual nonlinear advancements, the continual mashing and remashing of ideas, makes intellectual lineage much more difficult to separate and trace, with the effects also similarly swirling and slipping out of reach.[xvii]

After a decade of exposure to mobile phones, we still are not even sure what to call this phenomenon of storytelling with these devices. Mobile storytelling? Ambient storytelling? Geostories? Interreality? Mixed reality? Locative narrative? Ubiquitous media? Consistent terminology has become a concern within this field, a barrier keeping us all from talking about what we think we are talking about. Intermedial communication, as bland as that may sound, at least provides an extremely broad umbrella under which the fundamental discussions can begin, for it draws on the notion of "co-relations . . . that result in a redefinition of the media that are influencing each other, which in turn leads to a fresh perception." It suggests a "both-and approach" to understanding information rather than an either-or perspective.[xviii] The prefix "inter," Irina Rajewsky writes, denotes that intermedial action takes place between the media, like an adhesive that binds together the swirling mix of ideas. That helps to distinguish it from kin theories such as intramedial (within a particular media) and transmedial (a motif, aesthetic, or discourse spread across different media).[xix] Intermedial has become a term with expansive edges, including referring to the ways in which, as Robin Nelson notes, media "work together in digital culture to challenge established modalities of experience. … In some instances, they collide and create a frisson. In other instances, one medium is imbricated within another so that they are almost dissolved into each other but the form of one remains just visible in the solution of the other."[xx] Intermediality embraces ideas of media convergence, or, as Klaus Bruhn Jensen describes, "the interconnectedness of modern media of communication. As means of expression and exchange, the different media depend on and refer to each other, both explicitly and implicitly; they interact as elements of particular communicative strategies; and they are constituents of a wider cultural environment." [xxi] Intermediality also, in its most general sense, André Gaudreault and Philippe Marion argue, covers any process of cultural production.[xxii] Lars Ellestrom claims in the introduction to his *Media Borders: Multimodality and Intermediality* that "[i]f all media were fundamentally different, it would be hard to find any interrelations at all . . . if they were fundamentally similar, it would be equally hard to find something that is not already interrelated. Media, however, are both different and similar, and intermediality must be understood as a bridge between medial differences that is founded on medial similarities."[xxiii] A story like Fort Vancouver, with its innumerable nooks and angles and mysteries, needs such a malleable theory at its base to match the technological flexibility of mobile devices in order to bring clarity and wholeness to the informational chaos. Thus for us, intermediality serves as a theoretical given underpinning our views of the four types of interrelationships of mobile storytelling.

1. Interrelationship Between Content and Medium

The interrelationship that this unifying approach enables between content and medium is

empowering. *Majestic [http://www.nytimes.com/2003/03/06/technology/game-theory-it-s-just-a-fantasy-but-real-life-is-always-in-play.html?pagewanted=all&src=pm]*, credited by many as the first "alternate reality game,"[xxiv] incorporated telephone calls, faxes, emails, instant messages, and web pages to deliver a government conspiracy tale, all of which today could have been handled by a single device.[xxv] Mobile devices have absorbed, like that, the specialties of just about every medium—newspapers, television, radio, books, movies, telephones, Walkie Talkies, watches, cameras, audio recorders, calendars, video games, pagers, address books, desktop, and notebook computers, etc. Fields of specialization have been obliterated, and McLuhan's mantra of the medium being the message (as well as the massage) grows once again in ramifications.[xxvi] Authors suddenly are in control of virtually all media at once, from video to sound files to words, shaping discourse through convergent technologies. In the context of composition, this sudden sense of freedom and potential and optimism contrasts with the opposite emotions created by a lack of focus and operating outside a clear niche, creating yet another paradox of these devices. Jarvenpaa and Lang identify others as well, including the empowerment/enslavement principle, in which mobile users today have access to content at all times, every moment of every day, all year long, wherever they might happen to be, creating unparalleled knowledge access.[xxvii] That is, as long as the battery maintains juice, otherwise leaving the user as helpless as Superman holding Kryptonite.

The modern user, though, also remains in control of a ubiquitous and personal access point, creating just one of the complications for authors. This situation reflects or extends the parallels problematic in the 24-hour news cycle in which increments of information can gain unbalanced importance related to distribution goals rather than quality concerns. If the emphasis for the writer always is on "new" or "first," then the more substantial and worthwhile core of the discourse can get lost in the rapid distribution churn. Meanwhile, as the information changes with the times, the content inherently changes, as if composed on shifting sand, deadening or enriching nuances, shaping and reshaping the work, which could lead to the endless polishing of every piece, or more likely, abandonment that causes irrelevance, like the fading importance of Kane's sketches. Bringing it all together, through an intermedial paradigm, into a oneness, accepting rather than separating the interrelationships, creates a new kind of focus for storytellers. But it also creates new problems. Creators of mobile stories not only will need to choose and balance medial forms along with such narrative cornerstones as character and plot, but the fluidity of digital information and the growing expectations of the relevance of such information delivered through mobile devices, breeds rapidly rising quality considerations as well sustainability concerns.

2. Interrelationship Between People, Time, and Space

Jarvenpaa and Lang reference Martin Heidegger in noting that technology destroys

distance by destroying closeness, creating a condition in which everyone simultaneously is close and far, independent of geographical distance.[xxviii] Yet physical location also is the primary tether we have left to physical experience, and geographical and organizational proximity tend to naturally increase information flow about a physical location as well as interest in it.[xxix] In other words, our thoughts may be elsewhere, but our bodies can never be. And we inherently care where our bodies are. So instead of trying to force a separation that can never truly happen, an intermedial approach to mobile storytelling integrates tangible space with virtual environments. A participant's foot is in both worlds. The user is cognizant of that sensation, and so is the storyteller, with great compositional precision. Location awareness of mobile devices meanwhile offers some of the most promising and solid distinctions of mobile composition in which content can be positioned at a particular site, an extremely specific place, if desired, and that "mobile" information only can be released to people who go into that physical space and actually commune with the surroundings. In the Fort Vancouver Mobile project, for example, the story of a Hawaiian pastor is featured in the first module. This man, William Kaulehelehe, is emblematic of the importance of "Sandwich Islanders" to the establishment and development of the fort, but he also illustrates larger themes comparing and contrasting British imperialism with American expansionism. Kaulehelehe gets caught in the middle between these two enormous forces, and the final piece of the mobile narrative shows a video reenactment of an incident in which American soldiers raid his home and burn it down [video link above] as a way to rid the region of Brits. Only this video is not being played in the sanitized and detached theater space of the visitors center. Or accessible from a comfortable home office. This video is only available when digitally pushed to visitors via their mobile devices, after they have experienced several segments of Kaulehelehe's tale, and as they stand at the actual site of the incident, with the empty reconstructed Kaulehelehe home in the background. During beta testing of this narrative, visitors were highly engaged by such alignment of the digital environment with reality, indicating the potential of such intermedial space, when a user feels magically anchored to both worlds.[xxx] In *Electronic Literature: New Horizons for the Literary*, N. Katherine Hayles outlines the history of what she calls a "three-dimensions interactivity"—that is, the physical relationship between user and object in 3D space—noting Janet Cardiff's locative story "The Missing Voice (Case Study B)" as a primary example of this mobile phenomenon.[xxxi] Cardiff describes her piece as an "audio walk," which begins, with the user being physically connected to the content about to be shared through audio delivered in a precise spot matching the visual situation being described. In a similar fashion, users of the Paul Kane narrative module for the Fort Vancouver Mobile project are led through the storyline to actual places where Kane created his images at this specific site. They then are shown the images on their mobile devices, such as a painting with aborigines lounging on the banks of the Columbia River, near their

camp. Users can align geographic landmarks in the picture and reality, such as Mount Hood [http://www.fs.usda.gov/mthood/] and the Columbia River [http://www.crgva.org/], and they also can witness how dramatically the scene has changed since, with a highway interchange and railroad tracks and condos replacing the rural landscape. This experience of exploring spatially placed multimedia, even asynchronously with others, could be one of the ways that mobile technology can start to bring people physically back together in the same space. The question that appears on the phone interface, "Where are you?," in this sense, helps a user come out of the clouds of technology and back into a situated context, a place, where other people are, or have been, instead of existing as a disembodied voice floating around within the wires of the network.[xxxii]

With a dystopian bent, much of the early research on mobile devices initially focused on tendencies to disconnect users from surrounding spaces. Discussions, such as those by Janet Murray about nontrivial activities that interfere with immersion, prevailed until recently.[xxxiii] The general idea has been that deliberative movement and thought related to interacting with an interface would gain the user's attention and, so, move it away from the story itself. This disconnection, this break from the state of immersion, has been seen as a negative aspect of born digital stories. But what if immersion into the object is not the holy grail of storytelling and, instead, the goal is to unite the user with a particular space—could we not find a new quality, unique to storytelling, that is not beholden to print sensibilities?

Adriana de Souza e Silva and Daniel Sutko contend that interactive mobile experiences actually reconnect users in new ways.[xxxiv] While printed books and landline telephones transport users away from physical surroundings, by immersing users in their own imagination or in the focused interchange of audio conversation, the geolocative feature of smart phones take users into their physical surroundings. A printed book can take a reader to Mars, back in time to King Arthur's Camelot, or simply inside another human's perspective, but it can never know where he or she is making that mental leap from, or who the reader is (and other readers encountering the same piece at the same time are), or what other books of this genre the reader has enjoyed or disliked, and then respond accordingly when the reader is finished by offering other likely-to-please titles to explore. This "demassification" of media,[xxxv] without losing amplification attributes, such as enormous reach across innumerable barriers, radically changes the approaches that authors can consider when composing for such devices, connecting them to other users, information, and space in potent ways.

3. Interrelationships Among People

Various studies of users at parks, science centers, and museums have shown not only that the competition for time and interest is great but that visitors also are under no obligation

to pay attention. They typically do not even look at a majority of the exhibits, and when they do, they often spend far less time with them than designers project or even hope. In turn, many people are unwilling to devote sustained attention to media and messages that are not entertaining. Multimedia exhibits, such as audio tours, though, have shown to be more attractive to visitors and hold their attention longer.[xxxvi] Taking the multimedia allure a step further, using the site as a metaphorical game board merges the story space with the unpredictability of the site, including interactions with people inside and outside of the game, such as bystanders.[xxxvii] Random encounters with real people are what fuels gameplay in location-based situations, and discussion forums that connect players outside of the game, allowing them to share game experiences, help to build a community of players.[xxxviii] The success of connecting players to one another, seen in Blast Theory's *Uncle Roy All Around You [http://www.blasttheory.co.uk/bt/work_uncleroy.html]* —where street players using geolocative technologies interact with online players—is a case in point.[xxxix] On the dystopian side, Flanagan warns that this physical-virtual blend can become a new form of "entertainment colonization" as well, in which unaware participants are unwillingly commodified by the players.[xl]

Location also can work as an initiator that can evolve into much richer communication transcending the original place.[xli] But it is not a factor that authors traditionally have considered. From the intermedial paradigm, stories can be open to interlopers and unpredictable tangents. In another example, Jeremy Hight describes a city spot as "a collection of data and subtext to be read in the context of ethnography, history, semiotics, architectural patterns and forms, physical form and rhythm, juxtaposition, city planning, land usage shifts and other ways of interpretation and analysis."[xlii] His ground-breaking mobile narrative, *34 North 118 West [http://34n118w.net/]*, which chronicles the stories surrounding a particular GPS coordinate, demonstrated that "context and subtext can be formulated as much in what is present and in juxtaposition as in what one learns was there and remains in faint traces."[xliii] He characterized such storytelling efforts as "narrative archeology."[xliv] Another mobile narrative pioneer, Michael Epstein, offers a different perspective, envisioning mobile media as a way to bring audiences closer to issues and locales through a narrative overlay on maps that also can be consulted for geographic orientation and other data. He pictures these "terratives," as stories delivered through mobile devices "in tandem with real places and people."[xlv] Maybe the clearest perspective from here is the broadest view, one that expands even media ecology. Mobile devices can provide the full spectrum between physical and virtual environments, and they can flip the passive nature of experiencing most media around, into an active proposition. Intermediality works between media, but it also absorbs its surroundings by making connections. Without the nails and glue, a house is nothing more than a big pile of sticks.

4. Interrelationship Between People and Information

Interactivity, flexibility, and cohesiveness are the new cornerstones of such collaborative multimedia composition efforts, according to David Fono and Scott Counts.[xlvi] From this perspective, interactivity means giving users multiple opportunities to engage with the shared media artifacts in a variety of ways, as opposed to the traditional model of transmission and consumption. Flexibility is an organizational mantra, in that structures of organization may be encouraged but also disregarded by users. Cohesiveness is the key connection to the traditional paradigm of author, in that users should be able to build a cohesive product out of the shared objects, enabled to make a variety of connections and associations. While the behaviors in isolation might not be significantly different than those entrenched in media traditions—such as taking a photograph with a mobile device and publishing it, akin to using a single lens reflex camera and a mass media distribution channel—the complexity involved in those behaviors increase with the choices now afforded[xlvii]. As part of such complex interactions, mobile devices begin to take on traits more like shared objects than individualized terminals, another sign of this process fostering communal coagulation.[xlviii]

Moreover, mobile communication technologies clearly alter our experiences with physical space, particularly in the creation of hybrid realms that incorporate physical, digital and represented spaces. In these mobile "games," players physically move around the space. They collaborate with other users. They expand the game environment outside of the traditional game space, by merging different real and virtual spaces, and perhaps the most distinguishing feature, these activities take place simultaneously in at least two different types of spaces. These spaces do not directly overlap, instead being superimposed and connected through social actions.[xlix] As part of this new blend of place, the Internet's connectivity, stacks of digital information and the users, related services typically either embed information in space or foster social mobile networks and interpersonal communication related to proximity and geographical orientation.[l] Meanwhile, in almost every situation, storytelling predominates as a means of sharing experiences and knowledge.

Narrative structure functions as a basic cognitive means of organizing human experience and making sense of it, and that form, compared to exposition or other informational structures, is thought to be easier to read, summarize, and remember.[li] Interactive narratives respond to deeper fissures and generate negotiations of authorship, authenticity, veracity and the authority to tell stories. Mobile narratives, with their emphasis on real experiences and direct engagement with new articulations of relationships between space, time, and postmodern patterns, provide a salient example of a modern art form that is negotiating, patterning, and understanding our changing nature.[lii] Reflective of such social fluidity as well as bonding, composing for mobile devices may then be considered distinctive in its wide flexibility, ranging from multiple

entry points to transmedia characteristics, in which different pieces of information can be accessed and delivered in different ways. This medial evolution increases potential effectiveness by removing the physical or technological barriers of the past, when packages of information typically had to be, for pragmatic reasons, delivered only in one specific medium. Transmedia authoring, as described by Jenkins,[liii] may be the ultimate postmodern mobile ideal in which the full narrative only can be ascertained by accessing the distinct parts of this larger discourse puzzle, yet all of the parts also function individually and completely and satisfy users within the designed medium chunk. With the Fort Vancouver Mobile project, users can listen to an audio clip, watch a video, read digital text, or see images of any number of the site's artifacts, all separate media objects delivered through the same device; or users can look at paper brochures, examine real objects in the space, or navigate the reconstructed physical surroundings, each of which contributes a complete chunk of the Fort Vancouver story but not the whole story.

The receivers of this array of media generally are absorbing the information outside of classrooms or designated interaction spaces, as in the concept of a situated and lifelong learning environment, conducting tasks that Sharples classifies as "contextual lifelong learning."[liv] In that concept, learning does not happen at predetermined times in prespecified places. It happens whenever a person breaks from routine, reflects on the current situation, and resolves to address a problem, share an idea, or gain an understanding. These environments are dynamically constructed by mobile users, in situ, interacting with their surroundings, and the natural alliance of learning as a contextual activity with mobile devices creates a powerful new tool.[lv] That combination, in fact, might be the key to understanding how to effectively author for mobile technology. Composing for mobile devices, therefore, is not like creating a telephone transmission, although many people still call the technology a "mobile phone," and a telephone conversation could be created as a piece of composition for mobile devices, delivered audibly or not. It is not necessarily like a text message, or delivered through a pager, either, yet it could be like that, too, if desired. Unlike most tools in human history, which are intended to amplify physical prowess, the computer increase mental capabilities, and the mobile device has can be thought of as the first organ of this design, one that extends the human language system on both the receiving and sending ends as well as integrating directly with the brain.[lvi] It connects our minds and bodies with the vast external infoscape.

From that brain boost, authors using mobile devices have inherent audience-awareness capabilities, like those in the age of orality, when speakers knew everyone in the crowd. They knew what the audience wanted to hear, and intimately understood the context of the communication, including its physical place, its time of day, its season, what came before it, and the pattern being set for what might come after. Only with mobile devices, this sort of precise delivery can be automatically sorted and intricately

redesigned as a way to simultaneously tailor messages to the desires of each individual in the crowd, even complete strangers. Mobile devices in this process, then, can collect data from their users that assist authors in continually making better connections to the audience, in real time, and this data allows virtually unlimited on-the-spot calibration, instantaneously, like a built-in usability lab. Unlike most of the technology they can supplant, mobile devices can create a distinctively personalized experience with information, from ringtones and identity-reflecting phone gear to content delivery, ranging across entertainment and services spectrums, individually designed on a mass scale yet with which a single person can interact.[lvii] This is a long way from pencils and paper, or even the printing press.

Conclusion

Many aspects of mobile media—stories delivered through smartphones, computer tablets, etc. – feel familiar and like natural extensions of the media that have come before it. The physical act of writing text for a mobile device, for example, is the same as typing for any other digital media. Shooting a video, recording audio, layering animation frames, all of these creative routines have become familiar forms of expression. Just as Lewis and Clark [http://www.pbs.org/lewisandclark/], in essence, merely extended a walk in the woods, modern authors composing in mobile space begin by treading over comfortable compositional ground. The deeper the trip into this mobile media wilderness right now, the more fascinating and bewildering it becomes, and the more surprising fruits and pitfalls it yields.

Mobile means, in turn, are becoming the dominant technologies of human expression, the natural interface through which humans function, yet also a unique instrument of mediating communication between people and the world of inanimate objects.[lviii] Mobile technology, viewed as this chameleon-like interface, circuitously returns to McLuhan's "medium is the message" mantra,[lix] only instead of choosing between media options today, such as a magazine article or radio broadcast, mobile technology adds media choice as a layer of composition, as critical as deciding a protagonist and a plot. Audience awareness with mobile technology goes well beyond typical demographics of age, gender, and social class. Composing with a mobile device means being able to know precisely when and where your message will be delivered, and in what context. This interaction also no longer is a one-way transmission, of sender and receiver, meaning for mobile technology to truly express itself as a distinct form, a circuit of information should be created among participants. As such circuits cross, and interconnect, mobile stories will begin to spread and grow like wildflowers. While the author (or authors) only control a portion of that circuit, he or she does help to put parameters on it, and guide it, ideally keeping it from becoming meaninglessly unfocused, or drifting so far from original intent that the audience loses interest.

The New World, the Wild West, even the most outer reaches of space have been crisscrossed and mapped by our tales. Authors can no longer reach farther away for their frontiers, but, as an apt metaphor, mobile narratives are establishing and developing new territory. The story of Fort Vancouver already is being expressed in wayside signs, brochures, books, videos, podcasts, web pages, social media feeds, online photo galleries, and even through generic mobile applications that track user location and provide social updates and aggregated data, such as nearest restaurants. Rather than being completely commodified in the digital age, information still can maintain distinct value based on the quality of the interpreter and the interpretation. Paul Kane documented the changing world as he saw it, with a sketch pad. He traveled mostly alone, "scarcely meeting a white man or hearing the sound of my own language," for four years.[lx] While mobile development is rampant worldwide, composing mobile narratives remains a relatively lonely pursuit, rife with terminological and technological mine fields. Near Fort Vancouver, Kane noted [http://books.google.com/books/about/Wanderings_of_an_Artist_Among_the_Indian.html?id=yKwNAAAAQAAJ] that the "Indians" lived near the river, in "a little village—quite a Babel of languages, as the inhabitants are a mixture of English, French, Iroquois, Sandwich Islanders, Crees and Chinooks."[lxi] That statement inspired the creators of the Fort Vancouver mobile stories to find a local speaker of Chinuk wawa [https://www.google.com/search?tbo=p&tbm=bks&q=inauthor:%22The+Chinuk+Wawa+Dictionary+Project%22], the common jargon of the village, to give sound to Kane's images of the place. This small step brings the user that much closer to what Kane actually experienced as he was filtering the scene for posterity through his sketches. As the user walks different directions around the site, other characters emerge. Different plotlines converge and diverge. The linear entryway opens into abstraction, in which each user move reveals additional layers of history and other stories. It starts to seem like a hidden world emerging. It starts to feel like new connections are being made and old and broken connections are being mended.

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Appendix 5:

Submitted to Mobile Media & Communication

By Drs. Brett Oppegaard (WSU Vancouver) and Brian Still (Texas Tech University)

Running head: BODYSTORMING WITH HAWKINS' BLOCK

Abstract

Inspired by the intuitive prototyping method employed by Palm Pilot founder Jeff Hawkins, this formative field study recreates and reimagines his generative techniques as a new methodology that could be useful for mobile media designers. Viewed theoretically through an activity theory lens, this approach also integrates bodystorming ideals as a way to externalize and embody user perspectives about the potential of place-based media, in situ, using a proposed National Park Service app, funded by the National Endowment for the Humanities, as an example. Such data gathering, especially early in the design process, could help user-centered projects gather otherwise inaccessible feedback, leading to better designs, through tailored content and interfaces, particularly at the dynamic intersections of digital and physical space.

Keywords:

Mobile Media, Mobile App, Design, Activity Theory, Bodystorming, National Historic Site.

Bodystorming with Hawkins' Block:
Toward A New Methodology for Mobile Media Design

Introduction

Jeff Hawkins, inventor of the Palm Pilot, launched his ground-breaking, mobile computing product in the mid-1990s with just a small block of wood as his guide. By using that block to focus on his mobile needs, activities, and actions -- in context -- he was not wittingly trying to create a new research methodology. He was trying to solve business problems threatening the livelihood of his company. He could have chosen to invest in a high-end, system-centered usability laboratory. Instead, he went into his home shop, cut and shaped a piece of wood roughly the size of the hand-held device he envisioned, with a whittled-down chopstick for a stylus, and started imagining how the device might work in real-life scenarios. In a matter of hours, he designed the shape and "look of the machine that would change the world" (Butter & Pogue, 2002, p. 76).

Hawkins, in hindight, had pioneered an approach and research instrument that allowed him to create critical distance from his cultural-historical context, serving as an extending mechanism to perceive beyond the moment and to envision what Bell and Dourish (2007) describe as the proximate future, or the future "just around the corner" (Dourish & Bell, 2011, p. 23). Mobile media designers need such periscopic methodologies and instruments to gain vision and awareness about the constraints of current technologies and contexts, using momentary increases of perceptiveness to better imagine future uses and needs. Hawkins' wood block has established its place in industry lore, with the original instrument now housed in the Computer History Museum in Mountain View, CA. Yet scant academic attention has been paid to that instrument, or Hawkins' method of inquiry into ideas of mobility. The wood-block approach therefore deserves deeper examination as a possible new research methodology, to be applied in other contexts, with other users, to determine its potential viability. So this study develops a theoretical framework for such an examination as well as presents the foundations of that new methodology for applying Hawkins' block to any situations in which place-based media might be warranted and wanted.

Ubiquitous computing, as originally envisioned by computer scientist Mark Weiser, integrates both technological advances, such as mobile devices, and the imagination to envision new applications of those technologies in various contexts. Such innovative amalgamations inherently are, as Dourish and Bell (2011) describe, messy. They write that the "world is never quite as simple, straightforward, or idealized as it is imagined to be" (p. 4), and "the best way to understand the future is to do your best to create a local approximation and try to use it day to day" (p. 12). That essential process of actively being in a mode of discovery, metaphysically, suggests Heidegger's (1977) conceptualization of "bringing forth," or of humanity's constant pursuit of the proximate future, the continual push to be among the first to see and recognize as the blossom of a

technology metaphorically bursts into bloom. Heidegger argues that every instrumental act of bringing forth is an act of revealing truth, and, technology therefore is a way of revealing our essential truths (p. 12). In a practical sense, then, Dourish and Bell contend that people always will be assembling heterogeneous technologies, in an effort to achieve individual and collective goals, as a sort of bricolage, but those efforts also always will be in a state of bringing forth, as iterative improvements continually appear throughout an interconnected system, causing every other point to readjust, and inherently keeping the system in a state of flux, rather than providing a fixed target. The people who generate these new technologies, meanwhile, are products of social shaping, performing social actions, operating within social contexts, at particular historical moments, all of which guides the imagination of what needs technology might meet, and in what settings (Dourish & Bell, 2011). Researchers inherently are within such social and historical contexts as well, but they also can mindfully try to escape those, at least momentarily, to peer into the distance, and picture what is coming next.

Within such contexts, Hawkins carried his wooden "mobile device" around with him and interacted with it, as a way to reveal the next frontier of humanity, like the object was an obscured view, but a view nonetheless, of the powerful and pervasively connected communicator / computer it eventually would become. This wood block did not bear the burdens of what was technologically possible at the time, or pet ideas of any designer, or even the constraints and baggage of what previously had been conceptualized as the hand-held's domain. Hawkins merely followed his normal routine and pretended to use the block as he would like to use a mobile device, with his visualization of such a device melding the functions of other technological tools he regularly used at the time, such as the telephone, calendar, pager, notepad, and Internet-connected computer. This particular idea-generation process, for Hawkins, brought forth and shaped the design of the Palm Pilot (Butter & Pogue, 2002). He later reflected upon that wood-block method, through retrospective recall, as providing otherwise inaccessible insights into mobile development opportunities, which helped him and his company to beat the major business competition, including Apple (personal communication, May, 18, 2012).

As mobile technologies continue to emerge, and the mobile platform defines itself as a distinct medium, McLuhan's (1967) contention that each new medium creates unique potential for communication -- and that the medium, inherently, "is the message" -- deserves revisiting, particularly when considering developments during the past two decades in the applications of activity theory to HCI and other technology-focused fields (Kaptelinin & Nardi, 2012; Kaptelinin & Nardi, 2006; Nardi, 1996). Mobility introduces new dynamics to our media ecologies, by connecting users to each other and to locations, possibly both at the same time, while these users are physically in motion and/or engaged in everyday life activities. Such flows of information and communication can be seamlessly woven into the rhythms of everyday life, with important social ramifications

(Campbell, 2013). The mobile medium, in turn, can be considered the ubiquitous interface for contemporary society, through which we see *and experience* the world (Farman, 2012). So people do not just interact with their computers, from the corresponding activity theory perspective, they interact with the world *through* computers (Bodker, 1991; Kaptelinin & Nardi, 2012, p. 6). Mobile devices thereby epitomize the manifestation of the activity theory perspective. Gordon and de Souza e Silva (2011, p. 2) argued that mobile devices are generating a pervasive "net locality," or networked locality, in which something different begins happening to "individuals and societies when virtually everything is located or locatable." People are changing the ways in which they live, because of mobile devices, but also changing their internal projections of the proximate future, what they want to be able to do and how they want to be able to do it, to deepen users' interactions with the places they inhabit (Humphreys, & Liao, 2011). Researchers, in turn, need to work fast, developing methods to make those projections external, as a process of converting such ideas into design guidelines that can be immediately implemented and tested. From those circumstances and perspectives, this formative field study attempts to transform Hawkins' intuitive information-seeking response, through an activity theory framework, into a new bodystorming methodology for mobile app development, as an embodied style of brainstorming, to question if this wood block instrument can perhaps help designers better see the proximate future.

Activity theory as the theoretical lens

On the most fundamental level, research is a creative activity and also a form of interaction with the world, or another extension of Heidegger's "bringing forth" idea. After considering an array of theoretical perspectives with familial relations, including situated action, phenomenology, and distributed cognition, activity theory became the lens of this research design primarily because of its holistic scope, its emphasis on the empowering nature of artifacts to serve as "functional organs" mediating human experience, and the underlying premise of the theory, which suggests that design begets technology, and design is under the aegis of human intentionality and imagination (Kaptelinin & Nardi, 2012). An overriding principle of activity theory is the unity and inseparability of consciousness and activity (Rubinstein, 1946). At the theory core, therefore, is the "activity," which is generally defined as a purposeful, mediated, and transformative interaction. As the fundamental concept of activity theory, a unit of activity is understood in greater depth as a relationship between a subject (an actor, or group of actors) and the object (an objectified motive), which can be tangible or intangible, motivated by the subject's needs and viewed as dynamic and constantly under development. Yet the relationship, from an activity theory perspective, also hierarchically favors the object, rather than the subject, because the object provides the motive for the interaction, or the ultimate cause for human activities: needs. Needs – biological or psychological – that are not "objectified," or associated with a specific object (or

objective), create the stimulus that causes searching for the object. When a need meets its object, an activity emerges (Kaptelinin & Nardi, 2012). The wood block, through bodystorming, could help a latent need become objectified and transformed into an activity. An activity always contains various artifacts, from instruments and machines, to procedures and laws, to signs, forms of organization, and even just raw shared ideas. These artifacts play a mediating role, and relations between elements of an activity do not happen directly, but through mediation, consolidating concerns about an activity back to the artifact in focus (Kuutti, 1996). Artifacts, such as a mobile device or a wood block pretender, in turn, can profoundly extend and transform the human experience, assisting with the "bringing forth" (Nardi, 1996). When Hawkins used his wood block, for example, he recalled becoming so intimately aware of the feel, look, and navigation of the device he wanted to create that when engineers brought him the first plastic prototype, he instantly knew it was a half-millimeter too thick. More important, though, Hawkins said he knew, from the experience with the wood block, his new device would be engaging, throughout various types and levels of activity, and people would buy it. "What I did, by using it like that, was that I convinced myself that it would work. I convinced myself that the user experience would not be weird. It was going to be good, actually, and that people would like it. It was fun. And I think I didn't know that until I actually did it. Until you actually sit and try it, you don't really know" (personal communication, May 18, 2012).

As a measurable, an activity theory unit can be conceptualized initially as the simple relationship between a subject and an object, or an objectified motive. As the understanding of the relationship expands and integrates the mediating object, or instrument, a more complex relationship emerges; the artifact mediates and transforms the relationship between the subject and the object as well as the subject and the artifact. Engeström (1987 / 1999) expanded upon this foundation to demonstrate how networks of activity systems overlap, and interactions form with rules, community, and division of labor. Sharples, Taylor, and Vavoula (2010) were inspired by Engeström's model to craft their own framework for examining the holistic system of learning as an interaction between people and technology, again, the bringing forth, which then could be used by software developers and engineers to propose requirements for the design and evaluation of new mobile learning systems (Figure 1.0). Researchers meanwhile have begun to look toward theory to underwrite certain intellectual and ethical commitments, as prototyping has evolved. Activity theory's development as a theoretical lens, in turn, has become progressively more focused on design, and for use with ongoing projects, particularly as part of those exploring novel ways of supporting people with interactive technologies, creating an intriguing avenue of inquiry for navigating the messiness of the bricolage (Kaptelinin & Nardi, 2012). With a focus on such technological mediation, m-learning researchers, in particular, have been drawn to activity theory's potential for the creation of new educational models (Taylor, Sharples, O'Malley, & Vavoula, 2006), for designing

mobile learning environments (Uden, 2007), and for knowledge management (Liaw, Hatala, & Huang, 2010). The framework developed by Sharples, Taylor, and Vavoula (2010) for analyzing mobile learning extended the traditional activity theory dynamic of subject-object-mediating artifact as a way to look deeper at the technological and semiotic layers of mobile learning contexts. Those additional layers were focused on issues of control (defined by HCI and social rules), context (defined by the physical environment and the community), and communication (defined by the channels of information, protocols, conversations, and division of labor). Those three categorizations shaped the understanding in this study of user responses to the wood-block type of bodystorming, as a way to see through the messiness of digital development, described by Dourish and Bell (2011).

Bodystorming as an approach

Guided by that mobile learning framework, and based on activity theory principles, this formative effort to establish a new bodystorming methodology for mobile designers focused upon the interaction between the test subject and the objectified motive of exploring and learning about a historic site, through the functional organ of a wood block, as an artifact. Functional organs support and complement natural human abilities in building up a more efficient system – of internal and external resources – that can lead to the accomplishment of goals that could not be attained otherwise, like a scissor elevating the human hand to a precise cutting instrument, or a notebook enhancing a person's memory, or a mobile app tailoring data to inform about the particular situation of the user. Of central concern to HCI and related fields, such as mobile media communication, is the integration of computerized tools into the structure of human activity. What are the needs that necessitate the development of a new functional organ, such as a mobile app? What is the range of goals that a new tool, such as an app, might be intended to satisfy? What is the structure of the human activity before the assimilation of that tool, and how does the tool transform that experience? (Nardi, 1996). Those questions helped to shape this research design as it developed. But the perspective of this research also kept returning to the primary focus of activity theory, which is to identify needs of users; in this case, the users of mobile devices at a national historic site. When users walk around the historic site, what do they want to do? What needs do they have? Because of the limited literature in this field, and lack of models, even the users seem to have little idea. Could they see more clearly, and "bring forth," in the moment of "being there," with a wood block to help them focus? Could any mobile user play Hawkins' designer role in such a scenario, if given a wood block and a large question to explore, such as "What would you want your app to do here?" With that question as the core prompt of the study, bodystorming became the mode of "being there," as a way to enter the location-specific substrata of intertwined physical, social, interactional, and psychological contextual factors that swirls underneath each ubiquitous computing

environment (Oulasvirta, Kurvinen, & Kankainen, 2003). Dynamic, experiential, and generative, bodystorming immerses designers into user situations through loosely configured contexts, allowing users and designers to explore space and situations in tandem, while also increasing empathy about decision-making processes, interactive experiences, and emotional responses of users (Hanington & Martin, 2012). In short, bodystorming can turn abstract ideas into physical experiences, and observational data, as a form of roleplaying (Holmquist, 2008).

Bodystorming as an embodied idea-generation technique was created in the 1950s, as an offshoot of Osborn's (1953) brainstorming concept. Computer system designers similarly have incorporated role playing with low-fidelity prototypes into idea-generation exercises since at least the early 1980s, with the UTOPIA project bringing together the Nordic Graphic Workers Union and researchers from Denmark and Sweden, to design together through work organization games and mock-ups (Ehn, 1993). Bodystorming's initial application in computer system design reportedly did not take place until the 1990s, when Interval Research began exploring its potential. The company classified bodystorming as an "experience prototyping" tool, and, like Hawkins, considered such prototyping a key activity in understanding and developing interactive systems as well as a primary element of innovation (Buchenau & Suri, 2000).

The wood-block methodology

Traditionally, bodystorming sessions follow a few common steps: 1) Interesting phenomena are selected and edited into easily readable design questions, representing the phenomenon as a problem in the events, experiences and/or practices of users. 2). Participants go to the representative environment. 3) One design question at a time is given to users. 4) The attempt to solve the problem occurs in the place where the phenomena are directly observable, in which users are asked to act out the activities, with ideas recorded on site and later discussed and elaborated upon (Oulasvirta, Kurvinen, et al, 2003).

To choose an environment representative of a place-based attraction, several different sites near Portland, Ore., were considered. Those included the Oregon Zoo, the Fort Vancouver Barracks Cemetery, Multnomah Falls, the Cathlapotle Plankhouse, and the Fort Vancouver National Historic Site, which serves as a regional hub of the National Park Service. Because of the audience size and scope of the National Park Service site, as well as its many amenities and opportunities for mobile media, that place was chosen as the research site. Rather than focus this research upon the primary audience magnet of the site -- the reconstructed Fort Vancouver stockade, which is like a smaller version of Colonial Williamsburg, with costumed interpreters, regular demonstrations of period arts and crafts, and other interpretive activities -- the Fort Vancouver staff suggested a remote location of the site for the mobile media project, with many more technical challenges but with less distractions as well. Because that place, dubbed The Village, had vast untapped

potential in terms of media delivery and also presented more control over the research variables, it was agreed upon, and the partnership with the National Park Service began, with Digital Start-Up funding for the development of the project later provided by the National Endowment for the Humanities. When the research started, The Village had few physical amenities: A couple of walking paths, several grassy fields, a couple of interpretive signs, and a couple of small reconstructed houses, which mostly were kept closed and locked (Images 1.0, 1.1). However, it had a rich hidden history and location near the relatively new Vancouver Land Bridge, designed by renowned artist Maya Lin, as part of the Confluence Project commemorating the changes to the Northwest since Lewis and Clark passed through the region.

Representative users were identified as those within the National Park Service's Fort Vancouver communication channels, including social media feeds, and a short message was sent seeking volunteers to participate. The choice of a site and participants for such research therefore was made under the auspices of an established qualitative method called a "purposeful" sample (Koerber & McMichael, 2008). Additional screening confirmed that the first five volunteers to respond were between the ages of 18 and 65, with an interest in history and a general openness to new technologies, traits considered the essence of the target audience. These five people, (three female, two male) as an initial sample pool, were considered a large enough of a group to, at the least, generate an improved iteration and to identify "show-stopping" problems during discovery phases of research (Macefield, 2009).

Because the wood block would be given to users, rather than used as a tool for motivated introspection, as Hawkins used it, the test instrument in this case was crafted slightly larger, bulkier, and heavier than a typical mobile device, meant to serve as a constant tactile reminder to the user of its presence and as a way to keep the responses focused on content that could be delivered through the device, rather than just to generate general observations about the site. Field testing involving users could have been employed at a later date, when a more refined prototype was available. Also, any actual mobile device, with its interface disabled, could have been used instead of the wood block. However, user-centered design principles suggest the importance of engaging user involvement in the design process as soon as possible, especially in the actual environment of use, and to do so in such a way that as few of the design requirements as possible, including the interface and form factors, are present to influence the user's cognitive engagement.

Such an approach, of generating a low-fidelity prototype -- or what is sometimes called a paper prototype -- has value for a couple of key reasons, which warrant its inclusion, especially at the beginning of the user-centered design process. First, as Grady (2000) points out, users are more apt to offer up critical feedback, even "suggest significant flaws when the [application] design is obviously very rough" (p. 39). A

rougher, or low-fidelity prototype, encourages users, according to Still and Morris (2010) "to fully express their conceptualizations and, thus, reveal their mental models of a proposed design" (p. 144). Second, a low-fidelity prototype is a means of communication, and the lower the fidelity, as long as it is understandable to the user, the better because the designer and user can communicate openly from the beginning of the process, before even the designer has had the chance to make assumptions about the size of the device, the size of the screen, or other interface features. There must be some fidelity, but if, as Zdralek (2000) argues, the interface is how the designer and user talk to each other, lower fidelity prototypes allow for those "first attempts at a dialog" to happen sooner, and with less encumbrance.

Certainly, there are drawbacks to a wood-block prototype, too; the most obvious being that it does not, in its construction, resemble the final object that eventually will be used. Yet so much of that resemblance is dependent upon context of the digital bricolage of the moment, so we erred on the side of introducing, at this beginning stage, a prototype with the crudest refinement possible to allow the focus of this study to be specifically on the mobile activity within the actual use environment. Through that approach, users' conceptualizations theoretically could be included in a relatively unhindered way, in terms of reacting to the low-fidelity interface design elements, within that context, as a method to bring forth ideas. Subsequent prototypes, based on additional user and designer communication, could yield higher levels of fidelity per prototype and more specific feedback about design choices. As part of an iterative-design process, though, which eBay's Morgan and Borns call "360 degrees of usability" (p. 795), low-fidelity prototyping, such as the wood block we used, invites user participation, at almost the inception of the idea, and collaboration in the development of the requirements that eventually will be integrated into the elements of the application they, or those they represent, will use at its highest, production-level fidelity.

Our hypothesis is that the wood block, therefore, would be a better generative instrument for bodystorming than a functioning app prototype, because once the prototype -- no matter how spare or how well-developed -- reveals what it can and can't do, the user would be responding to the immediate design of the prototype instead of imagining the pure potential of the situation.

The procedures of this experiment were relatively simple and straightforward. During this process, each person was invited to visit the site, independently, at a prearranged time. The person then was oriented to the same spot at the Fort Vancouver National Historic site. The person was given the wood block, told it was representative of a smartphone running a new Fort Vancouver app that had no budgetary or technological limitations, and it could deliver any media imaginable -- including text, audio, video, graphics, 3D models, animation, maps, etc. -- then asked, "What would you want your app to do here?" As the test subject described the user needs emerging from this process,

via think-aloud protocol, walking around the site, other gentle prompts -- such as "What do you want the app to be doing now? -- were used, particularly when passing in front of the two small reconstructed houses at the location, wayside signs, and other landmarks. Think-aloud protocol, originating in cognitive psychology, is a common method of eliciting data about cognitive processes through verbalizations by test subjects, typically seeking to know what the subject is thinking about at that specific moment, and at times provoked by prompts from researchers (Ericsson & Simon 1985 / 1993; Jaaskelainen, 2010).

To compare the open-ended scenario with a more refined and focused launching point, a second round of research was conducted with the same participants. In this round learners were asked to imagine watching a short video about archaeologists on site finding a piece of Hawaiian coral, which then prompted them to get involved in discovering where the coral came from, and what it meant for the coral to be at the site. This session was also recorded and later transcribed and sifted, to remove side discourse, such as commentary about the weather, background on the research project, inaudible or incomprehensible matter, etc. The remaining 35,000 words of discourse then were separated into chunks of distinct design ideas, which then were coded as either related to control, context, or communication (Figure 1.0).

Results

Each person spent roughly an hour at the site with the wood block, with times on task ranging from 50 minutes to 70 minutes. In total, 300 distinct and chunked ideas related to mobile development at the research site were generated, or about one per minute of testing. With no specific scenario in place -- just a wood block and the question of "What would you want your app to do here?" – this purposeful sample of users focused about the same amount upon control (99 chunked ideas) and context (93), with only three mentions of ideas that involved communication issues. When the Hawaiian coral scenario was added, in the second round, control issues (60) nearly tripled contextual issues (24). Communication issues increased as well (10), but that increase also was connected to a new prompt question, added during this round, which asked specifically about users making connections to others through the mobile device. These responses then were pooled into the nominal groups (Taylor, Berry, & Block, 1958; Diehl & Stroebe, 1987; Rietzschel, Nijstad, & Stroebe, 2006). Instead of eliminating redundancy, which is a typical way of measuring productivity in bodystorming sessions, the ideas instead were clustered by a trained rater through affinity characteristics, as a way to look for common needs among the participants.

An example of a control issue that became clustered by affinity was the recurring idea that the site should be providing videos of the interpretation material, instead of large sections of text, like brochures and wayside signs do, with each of the five users making a similar request:

- Participant 1 (50-64 years old, female): " I prefer video. You know, actors, costumes, animals, and anything you could bring in to feel like that time, like recreating that life."
- Participant 2 (25-34 years old, male): "If there was a video of someone, you know, of the reenacters actually around the house doing their thing, whatever that was, whether there was a farmer, a blacksmith, or whatever. Being able to see that and sort of imagine that and seeing, OK, being able to actually visualize that, instead of just hearing or reading about it would be, would be pretty cool."
- Participant 3 (35-49 years old, female): "A short, little video, and that would probably be one of the best (ways to learn). I think text is great on a larger screen, but we are dealing with a smartphone."
- Participant 4 (25-34 years old, male): "Video would be important, if the production values are good."
- Participant 5 (35-49 years old, female): "I prefer videos, because I am just a video kind of a girl."

A context theme cluster, which appeared as part of all of the user comments as well, was the idea that the test subjects wanted to know specific and rich stories about the people who had lived at this particular site in the past, not just factoids, or generalities about the period:

- Participant 1 (50-64 years old, female): "So I might want to know more about some of the people who inhabited the village at this point. And so look at maybe what was available, I would assume they just have various scenarios available, and it might be about the people or what kind of work they were doing, or where they got their materials."
- Participant 2 (25-34 years old, male): "If this was a farmer's house. You know, if they, if they'd be out in their garden, or whatever, behind the house. Or if this was a hunter, like, even if he was just kinda cleaning his gun or whatever. Just kinda getting a feeling … A real name and a real person would be cool, if available. Just because I think that, when you hear that it tends to make it a little more personal."
- Participant 3 (35-49 years old, female): "I want it to give me more in-depth information than just this sign here. I want to learn about the people, the cultures. I want some insider's scoop. … Stories, you know people love to read stories. … I would love to find out some interesting stories about the people who lived here and how their lives might have been different if they had, if they had different cultural backgrounds."
- Participant 4 (25-34 years old, male): "Controversy. … People being upset or excited is more interesting than people being happy."

- Participant 5 (35-49 years old, female): "Maybe there was a family in this house out here, and you had the mothers from a couple of the different homes helping take care of each other's kids while they are cooking. That's like what was going on in this village. What were the people doing if their husbands were out working or shopping. What had the wives been doing?"

Along with the emergence of such clearly connected clusters, some individual comments were not as easy to categorize or lump together, or were non-sequiturs. These ideas represented an array of curiosities, attitudes and opinions. Participant 1 (50-64 years old, female), for example, mentioned, while walking between landmarks, that: "It would be fun to have music playing in the background here, music representative of the times." Participant 2 (25-34 years old, male) asked questions about the modern development plans of the site, including the pending bridge design and its traffic impacts, rather than maintaining focus on historical connections. Participant 3 (35-49 years old, female) suggested that not only should she be learning about what people ate at the site, she wanted to see their recipes. Participant 4 (25-34 years old, male) asserted that he wanted to know precisely how long of an adventure he was starting, before he began it. Participant 5 (35-49 years old, female) asked to be quizzed every so often, just to see how much she was learning. All of which indicated that the wood block process revealed needs that might otherwise have never been objectified, from an activity theory perspective.

Raw idea generation is never the ultimate goal of bodystorming, because pure productivity, or the number of ideas generated during a session, only demonstrates a limited view of the effectiveness of the exercise. A process that generates a lot of unfeasible or commonplace ideas is not necessarily valuable. Osborn's (1953) original conceptualization of brainstorming suggests that quantity leads to quality, though, in that with more ideas available, there invariably will be more good ideas within that mix. How to effectively tease out the good ideas from the chaff, and measure those results, has puzzled many researchers and remained an obstacle in this approach (Rietzschel, Nijstad, et al, 2006).

Discussion

This formative study was intended to provide results that could serve as guideposts for mobile designers, as a way to "bring forth" the ideas of the future. But in the process, the wood-block method demonstrated the potential to overcome the initial inertia on any mobile app project, giving designers the opportunity to talk to real users, within a specific context, and to learn what mobile technologies might provide in that particular place. Through that effort, designers might consider more clearly what to create and how to create and distribute it. Such a user-centered design approach is positively constructive because it emphasizes, according to Pratt and Nunes (2012), "putting the users in the center of the interaction design process, and taking into account their wants and needs" (p. 15). Faced with the often fuzzy front-end of design where

questions like what to do, how to do it, where to begin, and what do the users need, ultimately, to be successful, are better addressed by making users part of the process, from the very beginning. Many types of idea generation models have been introduced to support that critical part of the process, with mixed evidence regarding their effectiveness (Liikkanen, Hämäläinen, Haggman, Bjorklund, & Koskinen, 2011). The wood-block approach follows and extends the traditional path of user-centered design process models, which typically observe user activities, document those observations, and then create a design based on that documentation (Oulasvirta, Kurvinen, et al, 2003). Creating situations for representative users to engage with the proposed product, even at an early prototype stage, therefore, is crucial because, as Pratt and Nunes (2012) further note, "well-designed devices take into account the factors of the environment in which we use them. Well-designed objects take into account our bodies, offering clues as to how they will be used by their affordance or shape" (p. 16). If users aren't significant players in the design of the final product they ultimately will use, then critical knowledge will be lost that informs the construction of the product, and this will mitigate its successful adoption. At the very least, their involvement serves to deter "feature creep," which has plagued many products, especially mobile applications. Designers, working in the proverbial dark with little user feedback, have often overloaded on features to satisfy every potential need or want when, ironically, "the more features you add," Colborne (2011) argues, "the less chance you have of coming across a new feature that is of real value to someone" (p. 6). User-centered design helps to identify, through user activity, what needs to be there and what doesn't.

On the other hand, the openness and fluidity of this wood-block approach did not answer every question about creating dynamic historical interpretation with mobile devices, not even every question about this specific site. Users did not naturally migrate toward many of the areas considered most technically fascinating or artistically rewarding for skilled media practitioners. Users also typically are not as passionate about a proposed project, nor do they have as much personal investment, as the designers, which potentially could translate into a preponderance of shallow and visceral responses, rather than truly innovative and thoughtful ideas.

The wood-block approach did accomplish, though, what it accomplished for Hawkins; it generated massive amounts of user-centered data that provided intriguing patterns worth exploring. In other words, it created enough information to inform and drive future iterations. The wood block approach is inexpensive, takes minimal setup and time, and it can be done as early and as often as needed. It adds information and feedback benefits otherwise unattainable for a project with such a limited budget. This type of testing immediately gets the concept out of the creator's mind and into the hands of the users, in the spot they are going to be using it, and gives them a chance to respond in as much detail as desired. The sooner in the process this sort of experimentation with users

occurs, the earlier fundamental problems can be identified and addressed. Incorporating the learners into the design process from the beginning, and giving them so much freedom, also serves several important creative purposes. The learners, as temporary members of the team, contribute a wide range of fresh ideas for the group to consider during the ensuing iterations. They bring an outside perspective, focusing on the product, not the process or the personalities. They also are able to reveal the complexities of the relationship that will be developed between the app and the person, amid the messy development sphere, putting that link into perspective, in which the user might have unforeseen agendas, or not be as focused or as concerned with fine details that might obsess designers and create production bottlenecks.

On the negative side, as research questions became more specific and detailed, and closer to actual production, such as in the second phase of this study, the user responses appeared to increasingly depend upon – and likely could have been influenced by -- researcher prompts, indicating the probable need for higher-fidelity prototypes to reach more precise calibrations and to avoid transferring bias from the researcher to the test subject. In addition, observations at this site confirmed the bodystorming concerns that Oulasvirta, Kurvinen, et al, (2003) raised about such approaches, including the notion that, even with a wood block, some locations simply are not physically accessible; for example, users cannot enter the locked houses. Some ideas are not cognitively accessible, especially to those not aware of the history, or who haven't spent a lot of time in the location. Some actions are not socially accessible, due to the nature of having a researcher in the midst, instead of a typical companion, such as a family member or friend, and some options are not ethically accessible, with privacy concerns restricting access.

This wood-block method also is not intended to take all of the power from the designers and put it into the hands of the users. No one is suggesting that designers are not needed any more, or that all parts of systems-oriented design should be discarded. Rather, this user-centered design approach, as the wood-block project demonstrates, is a new one that reflects an ecological re-interpretation of design. Ecologists study micro-systems to reveal information, not just about the organisms within that system, but also how such revelations convey knowledge about surrounding larger systems. In fact, user-centered design isn't about just the users. It is an effort, on a small scale, repeated iteratively, and begun as early as possible, to "reveal more knowledge about the behavior and structure of an entire community" (Still, 2010). Or, as Heidegger would describe it, a bringing forth. We test with a focus on users because what they bring to the product reflects the world beyond the product, and what we learn from their activity engaged with the product improves knowledge not just of the product interface, but also of how people use any variety of products. We understand the mental models and affordances they carry with them and the ways in which that influences design.

The goal, then, is not to fully convert the user into the designer. The goal is to give this primary stakeholder a place at the table where decisions are made. Inevitably, bigger issues are dealt with earlier, which often translates into cost savings if not the mitigation of use problems later on when they are more difficult to address. Still further, with the recognition that what makes interfaces more complex now is the mercurial nature of who uses them, how they are used, and where they are used, user-centered design offers the means to engage in design that doesn't necessarily have an end, but does have a proactive solution for variability.

In the current development environment, such an approach is practical as much as it is enlightening to those in the business of creating location-specific apps that fill niches no conglomerated organization would ever stoop to consider. With this mindset, the commitment to try a project out takes almost no discussion. Such formative research can indicate areas of potential as well as "show-stopping" flaws in design ideas. There is nothing to lose, much to gain, and even if the original concept is wrong, the next low-fidelity round can alter and fix the strategy immediately. These ideas and prototypes generated from the wood-block approach are built as much upon user feedback as designer heuristics, meaning they can integrate the strength of both. This kind of app development meanwhile does not take thousands or even hundreds of designers and programmers. It simply takes an idea and some gumption to try. Also, a wood block definitely seems to help.

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Images and Figures

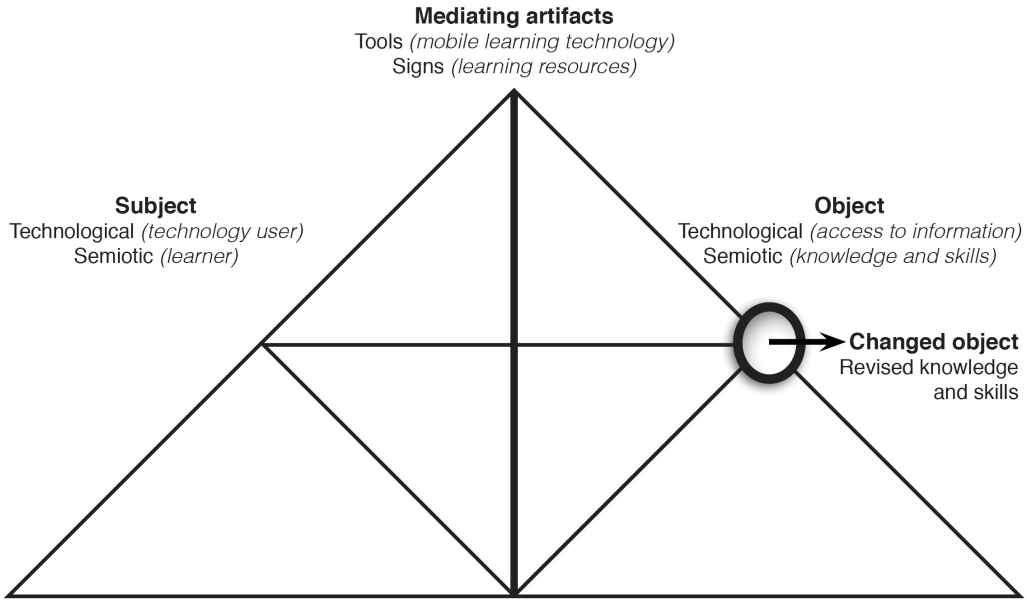
Image 1.0

The Village at the Fort Vancouver National Historic Site in 2012.

Image 1.1

A wayside sign and reconstructed house at Fort Vancouver National Historic Site.

Figure 1.0



Control of mobile learning dynamics might rest primarily with one person, such as the teacher, or it might be distributed among the learners. But it also might pass between the learners and the technology, through design and use of the system.
This element of the mobile-learning framework is concerned with how the learning opportunities are delivered, including control over access to materials, the pacing, and the style of interaction. It also relates to the sovereignty of the learner, allowing that person to remain independent and in a position of competence, while personalizing the system to each individual's desires.

When frozen in the moment, a context state is a snapshot of a dynamic interaction that contains all of the elements from the learning process and setting at one particular point in time, space or goal sequence; particularly those relevant to a learning focus, such as the learner's current project, episode or activity.
Mobile systems also offer functions for learning activities, such as the ability to retrieve content or information, or, in other words, to share knowledge between the system and the learner. In turn, they provide functions that could encourage and enhance such learning through mobile technology.

This element encompasses the ways in which a mobile learning system enables certain forms of communication, such as messaging, file sharing, or public posting of images, video, text, etc. The dialectical relationship between the technological and semiotic layers of the mobile technology helps to stimulate individual as well as collective forms of meaningful communication. The system meanwhile can create various interactions and communication channels to support diverse learning activities, based on the idea that learning occurs within a larger sociocultural system, and many learners interact to create a collective activity framed by cultural constraints and historical practices.

Figure 1.0: A framework for analyzing mobile learning, from: Sharples, M., J. Taylor, et al. (2010). "A theory of learning for the mobile age." Medienbildung in neuen Kulturräumen: 87-99; Lonsdale, P., C. Baber, et al. (2004). "A context awareness architecture for facilitating mobile learning." Learning with mobile devices: Research and development. J. Attewell and C. S. Smith (eds.): 79-85; and Liaw, S. S., M. Hatala, et al. (2010). "Investigating acceptance toward mobile learning to assist individual knowledge management: Based on activity theory approach." Computers & Education 54(2): 446-454.

Appendix 6:

Submitted to Educational Technology & Society

DESIGNING HISTORY LESSONS FOR MOBILE LEARNERS AT A NATIONAL SITE

Brett Oppegaard
14204 N.E. Salmon Creek Ave., Washington State University, Vancouver WA 98686-9600
Tel: 360-521-8150; Fax: 360-546-9074; E-mail: brett_oppegaard@wsu.edu

Olusola Adesope
356 Cleveland Hall, Washington State University Pullman, WA 99164-2114.
Tel: 509-335-2771; Fax: 509-335-6961; E-mail: olusola.adesope@wsu.edu

Abstract

Informal history education, including many popular museum learning studies, have shown that mobile media objects, such as apps, quickly could become critical parts of the predominate learning technologies of the future. In the process, this could lessen the overall pedagogical focus for history education on aural transmission, such as lecturing, as well as traditional media delivery systems, such as printed books. Having "an app for that," though, is just the start of the process of developing effective, efficient, and evocative learning systems. This case study describes a National Endowment for the Humanities-funded mobile app designed in situ and deployed at a National Historic Site with the intention of creating a mobile learning model for the National Park Service. After the app module was created and released to the public, an independent evaluator was enlisted to perform a LORI Analysis on the project, to assess the efforts as they related to informal history learning objectives. This evaluation identified potential best practices for the design of these types of mobile apps, such as interactive activities enabled by the mobile technology, as well as opportunities for improvement in the design of such learning systems.

Keywords:

Mobile, App, Design, Action Research, National Historic Site.

Introduction

History education has been foundering in the United States, with national test scores as well as funding in the field generally remaining stagnant, or declining, for decades (Symcox, 2012; "National Assessment of Educational Progress," 2010; Yarema, 2002). The effectiveness of traditional lecture-based pedagogy meanwhile has been questioned, and a variety of new methods for learning history have been proposed, including those enabled by technological advances, such as learning with mobile devices (Hung, Hwang, Lin, Wu, & Su, 2013; Kearney, Schuck, Burden, & Aubusson, 2012; Rogers, Connelly, Hazelwood, & Tedesco, 2010; Vavoula & Sharples, 2009; Lee, Doolittle, & Hicks, 2006). While no known studies

suggest that history educators simply need to lecture more, or write more books, for the field to thrive once again, a flurry of recent research studies – typically focused on museums – suggest ideas that new digital media forms could help to change the trajectory of history education in positive directions (Huang, Liu, Lee, & Huang, 2012; Sedano, Sutinen, Vinni, & Laine, 2012; Cho, Yeh, Cheng, & Chang, 2012). Mobile apps, as an extension, have become particularly poised to benefit history educators, from a variety of different perspectives and in a variety of different ways, as numerous studies have shown (Farman, 2012; Gordon, & de Souza e Silva, 2011; Sharples, Taylor, & Vavoula, 2010; de Souza e Silva, & Hjorth, 2009; Crow, Longford, Sawchuck, & Zeffiro, 2009; Akkerman, Admiraal, & Huizenga, 2009; Azaryahu, & Foote, 2008; Raessens, 2007).

The American Historical Association (2008), when presented with the fundamental question of "Why Study History," offered two core defenses: 1. History helps us understand people and societies, and 2. History helps us understand change and how the society we live in came to be, by showing what elements of an institution persist despite change. Within that reasoning, then, history also provides people ways in which to understand their own lives as well as offers a moral compass, a source of identity, and paths to better citizenship.

A thorough examination of the myriad of issues facing the U.S. history education system or a fundamental argument for history education as a core component of a liberal arts agenda, is beyond the scope of this article. This piece instead makes the assumptions that history should be vigorously taught throughout formal and informal educational systems and that simply providing more of the same traditional pedagogy will not lead to a resurgence of this field, any more than requiring broccoli to be served in schools will lead to better overall student health and wellness. Of primary concern in this article, then, is the ways in which mobile technologies, and tailored, place-based media, could offer unrealized potential for improving history teaching and learning as well as provide engaging and interactive options that could help to redefine the field.

In an effort to explore such possibilities through action research, a mobile app prototype was designed, built, and launched at a National Historic Site in the Pacific Northwest (Fort Vancouver), then evaluated using a Learning Object Review Instrument (LORI) scale analysis. From an action research perspective, this case study thereby demonstrated ways in which a mobile app could improve history pedagogy not only in this particular place, under these specific circumstances, but as a model for use in other contexts, with different content. As such, this research project originated not from a specific interest in regional history, or historical interpretation, or even mobile devices in general. Its inspiration came from a recognition of – as well as a curiosity about -- the emergence of the ability of mobile devices to "see" places in different ways -- as far back in time and with as much detail as one wanted -- characterized as the "dynamic peephole interface" (Rohs, Schoning, Raubal, Essl, & Kruger, 2009, p. 1; Hurst, & Bilyalov, 2010, p. 1). Indeed, Hight (2003, p. 6) envisioned such place-based media composition through mobile devices as "narrative archaeology," in which the author, by composing and embedding narratives and sound in physical locations, is "establishing artifacts culled from layers in time." Examining that phenomenon within a history education format simply became a logical extension of the idea.

An action research approach

If the essence of research is creating new knowledge, action research does that through inquiries conducted within specific and often practical contexts (Koshy, 2005). The action research mantra, established by Fals Borda (1979), is to: "investigate reality in order to transform it" and transform reality in order to investigate it (Kemmis, 2006). To follow that mantra, a fundamental binary choice had to be made at the onset of this research process. That was to decide whether the work would be done from an outsider's or an insider's perspective, to establish the positionality of the researcher to the research. Positivists conceptualize the researcher as a spectator, who is able to detach from the surroundings, and access "Truth." This Baconesque figure is thought to view the world from afar, through an objective lens, while "hypodermically" controlling variables. The socially constructed predominance of positivism as the ideal manifestation of research purism, at least in the United States, has led to an increasing divide between scholars/science and industry/practice as well as to a national top-down social engineering emphasis (Herr & Anderson, 2005). The interpretive perspective, from which action research generates, instead acknowledges the researcher as an insider, as a part of the fabric of the inquiry, and an indivisible element of the environment, within which people, including the researcher, are interacting (McNiff & Whitehead, 2006).

Researchers traditionally tend to try to distance themselves from their work, as if such separation somehow distinguishes the results as "more plausible, credible, perhaps even more 'scientific'" (Burnaford, Fischer, & Hobson, 2001). Lewin and Lewin (1948), though, contended that the person stands at the center of his or her life space, and that an understanding of that life only can be accomplished by beginning with the perspective of that individual, or, put into a research context, that the researcher starts exactly where he or she is, and then tries to *do* something. Knowledge, in turn, can be created from problem solving in real-life situations (Herr & Anderson, 2005). Such a personal emphasis on knowledge building is reinforced by Piaget, Gardner, and Dewey, who wrote (1985, p. 39): "The discovery is never made; it is always making" (Burnaford, Fischer, & Hobson, 2001). Polanyi, who also emphasizes "personal knowledge" (1962, p. viii), noted that into "every act of knowing there enters a passionate contribution of the person knowing what is being known, and that this coefficient is no mere imperfection but a vital component of his knowledge."

The purpose of action research, according to Reason and Bradbury (2001), in turn, is the production of practical knowledge, useful to people in the everyday context of their lives. They state (p. 2): "Action research is about working towards practical outcomes, and also about creating new forms of understanding, since action without understanding is blind, just as theory without action is meaningless." An interpretivist approach, incorporating descriptive statistics and qualitative methods, is inherently anti-positivist and concerned with understanding perceptions of the world, not a single objective reality. Within this paradigm, different versions of events are inevitable, depending on perspective, and explanations of those varying perceptions are rich and valuable. As part of the action research framework, the techniques for inquiry are practical, cyclical, and problem-solving by nature, meant to generate change and improvement at the local level (Taylor, Wilkie, & Baser, 2006). Also embedded within this type of research is the idea that the builders of a system gain knowledge in ways that an observer cannot. The relationship between knowledge and practice is complex and nonlinear, and that the knowledge needed to clarify practice relates to context and situation (Campbell & Groundwater-Smith, 2007).

With such a perspective, this study focused on the material, concrete, and particular practices of particular people in particular places, in the "here and now." Rather than taking a more abstract view that construes -- but does not constitute – practice, this research approach aimed to demonstrate that understanding comes from clear awareness of social and educational practices in situ. That focus meant the emphasis for interpretations are drawn from the product of the specific material, social, and historical circumstances that

produced the practices, and by which, they are reproduced regularly through social interaction in the particular setting (Kemmis & McTaggart, 2005).

While supporting creative freedom and innovation in research, such an action-based cultural heritage project with a multimodal emphasis, like this Fort Vancouver Mobile project, also builds skills and experience. Those developments, at least in this particular case, come in various styles of writing, editing, graphic design, photography, videography, collaboration, team coordination, public relations, marketing, and computer and Internet technologies. In addition, the public benefits as well from such an app being created (Henson, 2005), with the hundreds of people involved in the app development, testing, and use gaining access to historical material in innovative digital forms as well as building a new community of people interested in such mobile historical interpretation, around the process of creating the project.

Core action research goals are to improve practice and develop individuals as well as to transform practice and participants (Herr, & Anderson, 2005). "When we build, we do more than create content," wrote Thomas and Brown (2011, p. 94). "Thanks to new technologies, we also create context by building within a particular environment, often providing links or creating connections and juxtapositions to give meaning to content." They added (p. 96), "By participating in the making of meaning, we also learn how to judge and evaluate it, giving special sensitivity to the ways information can be shaped, positively as well as negatively." During such a process, the creator transcends "from experience to embodiment, where the personal investment in technology and digital media changes the focus from social agency to personal agency. When that happens, technology and digital media begin to be viewed as an extension of oneself" (p. 103).

To then assess the app product and its effectiveness as a learning tool, an independent evaluation was conducted using a Learning Object Review Instrument (LORI, Leacock & Nesbit, 2007). Descriptions of the LORI evaluation of the app are presented in the results section.

Method

To begin to describe what the Fort Vancouver Mobile app became during this prototyping process involves also describing what parts of the endeavor will remain otherwise unmentioned, due to space constraints. To call this project an app is to flatten the hundreds of iterations of this app into a single piece of mobile software, frozen in time, despite the fact that with mobile development, the creation and refinement process was more fluid than that and never really ended. Since this app was launched to the public in June 2012, many more versions of it have been uploaded, and the app today maintains mostly familial resemblances to the app described here. In addition, this accounting of the app development process will not describe the dozens of meetings and site visits; the thousands of pages of historic source material perused, including maps, images, and journals, which then laboriously were remediated into digital forms; the countless number of informal conversations, ranging from information gathering exchanges to formal partnership building; or the innumerable dead ends as well as pilot tests and experiments that ensued. Instead, this article's description focuses primarily on the efforts undertaken to make this app an engaging educational tool, and to reveal the related behind-the-scenes processes conducted in the creation of one module, or interactive storyline, within the app, dubbed "Kanaka."

Choosing a place

Figure 1: The Village area of the Fort Vancouver National Historic Site, as seen from the Maya Lin-designed Land Bridge.

One of the initial and most critical choices made during this process was site selection. That decision not only affected the potential of the content within the app, the mobile affordances, and the setting in which it would be deployed, the choice also dictated who the collaborators would be, and what constraints those collaborators would put on the process. After consideration of several locations -- including a regional zoo, a landmark waterfall, and a variety of historic places – the Fort Vancouver National Historic Site was chosen, primarily because of its affiliation with the National Park Service, its 1 million annual visitors, its many supporting amenities, its location near the main north-south highway on the West Coast (Interstate 5), and the eagerness of the staff to participate in the project. The main attraction of this site was the reconstructed Hudson's Bay Company stockade, which presented an atmosphere like a scaled-down version of Colonial Williamsburg, with costumed interpreters, regular demonstrations of period arts and crafts, and other interpretive activities. To limit the interpretive variables, though, a more remote section of the campus was chosen for the focus of the mobile app. This section, called The Village, had been a blackberry patch and a homeless camp just a year earlier, but, 150 years before that, it also had been the hub of a huge European-based settlement on the West Coast. After mowing down the blackberries and camps, and adding walking paths and a couple of reconstructed houses, the site -- with a Maya Lin-designed walking bridge to the south, and the fort's reconstructed stockade to the northeast – attracted an average of 12,000 passersby a month (G. Shine, personal communication, September, 1, 2010). Without the resources to conduct a thorough demographic survey of site users, the assumption was made that visitors to Fort Vancouver primarily were a recreational audience, like those present at other sites of its kind. From that viewpoint, the audience roughly was thought to be composed of the same people who choose from a variety of leisure time activities in the area, including attending museums, movies, sporting events, family parks, etc., and that those people are culturally diverse, multiply-educated, -abled, and –aged learners (Kim, 2005).

In The Village, a wayside sign marked the entrance, and another one had been placed in front of the westernmost of the two small houses (see Figure 1). Otherwise, no traditional media was being offered in the immediate vicinity, and the houses were kept empty and locked, making the media richness value appear quite low, except during rare special events that included live demonstrations and costumed interpreters. This dynamic offered a relatively controlled – and controllable – setting, akin to other unstaffed National Park Service sites. The Village therefore could be considered a model mobile learning environment, in that it is fully mediated, through curatorial reconstructions, grounds maintenance, and the educational content available, and the juxtaposition of the digital and the physical could be kept in rough balance. Without the mobile app, visitors to this site encountered little in terms of historical context and

guided pedagogical scaffolding. The staff members expressed assumptions that visitors to this part of the 350-acre campus would enjoy and appreciate technological assistance in learning about the place, through electronic media, but rather than start by testing those base assumptions, we made the decision, per Herr and Anderson (2005), to begin by doing something with mobile technology in The Village to allow observation of how users responded to the progressively higher fidelity versions of the app. Design research, at its core, is aligned with other traditional research principles in terms of being inherently systematic and done in an effort to produce knowledge. Vannotti (2008) further describes the process as highly iterative and user-centered, starting with low fidelity prototypes and gradually creating higher fidelity models through rapid iterations. "This repetitive cycle and the interplay of designing, testing, and optimizing, bring me closer to the preferred solution," he said, "At the outset of the design process, however, it is not yet clear when exactly that point will be reached" (p. 53).

The interactive story

Similar to the site selection process, the initial story selection process included lengthy discussions over potential topics of high interest to learners in The Village, involving many stakeholders and many sessions. The short list of topics included diversity of the inhabitants; archaeological discoveries and investigations; slavery and emancipation; diseases of the period; and the influx of native Hawaiians to the place, during the late 1840s and 1850s, when fur trapping began to wane, and mercantile opportunities arose. In the end, the design team became most excited by the opportunities of the Hawaiian story and its potential to also include archaeological context.

To summarize the appeal, The Village had so many Hawaiians come to this area during the key period, looking for work, that the Hawaiian term for "person," which was "kanaka," became the slang name for the place, as in "Kanaka Town," or "Kanaka Village." One of the site's most important historically documented characters, William Kaulehelehe, served as a popular minister and apparently carried such sway that when the U.S. Army decided to establish its presence in the area in 1850, one of its key moves was to burn down Kaulehelehe's house, as a way to get him to leave. Such details created a compelling protagonist and a rich narrative to build upon, from a storytelling perspective, while archaeologically, Hawaiian coral found in the area had led to interesting technical discussions among the staff about its origins and purpose. The media creators on the design team were intrigued as well by the possibilities offered through period Hawaiian songs and dances, as well as the religious and colonization undertones, creating a significant cultural impact on the development of the Pacific Northwest. So the interactive design for the app module began to develop generally around the idea that Hawaiian coral had been found at the site, and the Fort Vancouver staff would like the visitor to help unravel the mystery of why it was there, and what that information could reveal about the people who lived in this place during the apex of Fort Vancouver.

Hight's work in Los Angeles (2003) and the Dublin Liberties Neighborhood project by Nisi, Oakley, and Haahr (2006) were models for this project, in an effort to keep the characters as real as possible. Nisi, Oakley, and Haahr (p. 2) contended that "factually based stories appeal to us because they are directly connected with what we perceive to be 'real' events and history. Such stories can provide us with inspiration in our own lives, prompting us to recollect anecdotes and trigger personal memories. Like a spider web, real stories lead into each other; they connect characters and themes providing a natural hyperlinked structure that can be used as the basis for an interactive modular narrative."

Once the decision to tell the Hawaiian story was made, a connection and partnership was forged with the largest Hawaiian cultural organization in the region, the Ke Kukui Foundation, to craft an ethical and culturally sensitive module. The backend Web development issues along the way were too numerous and varied to include in this piece, because of space constraints, but, as a part of this article's focus, with historical documentation as a tether, a variety of mobile media techniques were implemented with the affordances of the medium at the forefront of design decisions.

Those included:

* Establishing an immersive point of view – The learner was positioned as being an integral part of the app-using experience, including being asked to help solve the mystery and to produce and provide media at various steps in the storyline. Grumet (1987) suggested that the "triple-telling" of a recollection can break the three states of reflection into past experience, present situation, and future images, which "splinter the dogmatism of a single tale" and free the author from "being captured by the reflection provided in a single narrative" (Burnaford, Fischer, & Hobson, 2001). With that idea in mind, the solution therefore became using the present-day arc of an archaeology school operating on site, as a fictional framing device, setting up the situation that triggers the Hawaiian story. In more pragmatic terms, the first video that was pushed to learners at the entrance to The Village showed archaeology students finding something interesting on site, although not showing exactly what that was, near where the learners were standing. The learners then were asked, "What do you think they found?"

* Embracing interaction -- That textual response sent by the learners and their mobile devices to the server was collected and published on a secondary Web site, to allow the learners as well as the general public to later read the various guesses, which included in early testing such thoughts as "a dinosaur bone," "keys," and "gold." After that framing device was completed in the second video pushed to learners, about 50 yards away, with the revelation that the students had discovered a piece of Hawaiian coral on the north bank of the Columbia River, the rest of the module essentially provided historical reenactments in text, imagery, animation, and videos in various other places on site, aligned with landmarks that were visible both on the screen and in the physical environment. The learners, in turn, were asked, through various forms of prompts, to provide responses in text, still imagery, audio, and video, as part of creating and continuing the experience.

* Playing with media forms – The Kanaka app module includes a major puzzle/game, in which learners have to find the protagonist's missing newspapers by walking around the site and crossing media-triggering hotspots, which include interactive quizzes. In other sections of the app, Twitter-like dialogues take place among historical characters. In those conversations, collections of lines from letters and journals and books from the period were stitched together, including snippets of text directly related to Pastor William Kaulehelehe's life at the site, creating the illusion of a direct dialogue between him and other historical characters, such as the fort's chief factor John McLoughlin. For example, McLoughlin wrote in a letter to the Hawaiian consul that he would like to have a Hawaiian pastor come to Fort Vancouver to proselytize and calm the wild ways of the Sandwich Island laborers. This was just a small part of a long letter, and the reply, in turn, came back as a piece of larger document. In other cases, mentions of Kaulehelehe were part of the larger conversation, but not directly relayed to other characters in the story. Yet by snipping these mentions out, and piecing them back together, or, in other terms, remediating and remixing them, a new interpretation of the information was formed, and shared, in increasingly more sophisticated visual ways.

An interactive educational tool, like the Fort Vancouver Mobile app, inherently must be a collaborative process, because the projects typically are too complicated for any one person to control every element or to be knowledgeable about every detail. To thrive, team members must pool their knowledge, by problem solving and brainstorming together, and ideas must be welcomed from throughout the team, whether that person is focused on the specific area of the suggestion or not. In short, as part of this kind of research, team building also was a systematic, mindful, and detailed process critical to the completion of the app, using the framework advocated by Miller (2004). As of this publication, the Apple and Android apps had been downloaded more than 1,500 times, and the behind-the-scenes blog on this project, www.fortvancouvermobile.net, has recorded more than 25,000 page views. From a constructivist perspective, as m-Learning inherently tends to be, learners build their own meanings in such situations, and tests of explicit knowledge transfer generally are insufficient for assessing the overall effectiveness of the learning environment, so various evaluation tools were considered, before a Learning Object Review Instrument (LORI) was chosen and applied to the app by an independent, external evaluator (Leacock & Nesbit, 2007).

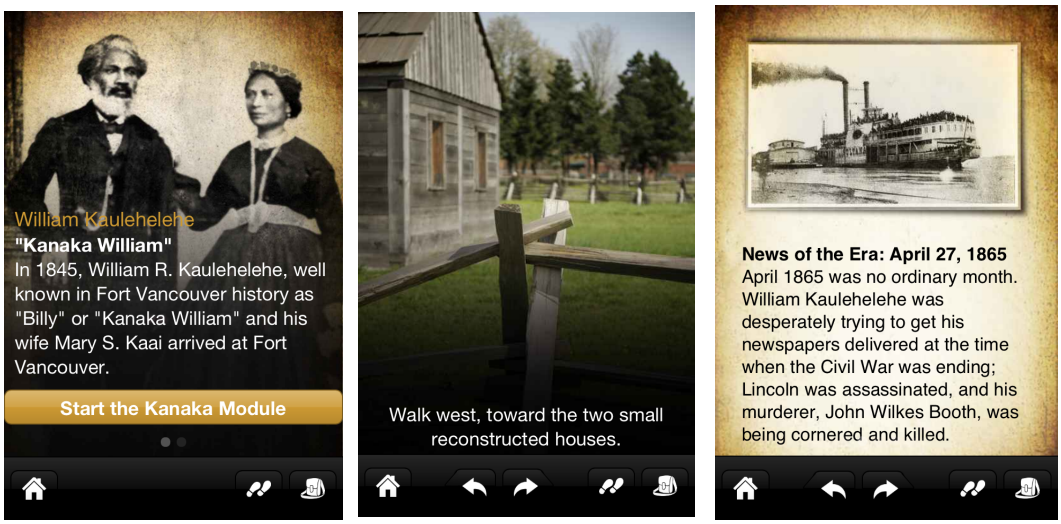


Figure 2: Screen shots from the Kanaka module.

RESULTS

Evaluation of the App

The Fort Vancouver Mobile app, especially the "Kanaka" module, can be considered a learning object. Although there is no general consensus on the definition of learning objects, most researchers agree that they are reusable digital learning resources that are designed based on sound pedagogical practices and

aimed at promoting learning (Sampson & Zervas, 2011; Churchill, 2007; Wiley, 2004). Although there are many instruments for evaluating a learning object, LORI is commonly used, and the external researcher conducted an extensive evaluation of the Kanaka module using that instrument. In the following section, the results of the evaluation are reported, including suggestions for further development of the Kanaka module and the Fort Vancouver Mobile app. The evaluation results do not include an extensive description of the nine dimensions of LORI as previously published papers on LORI have adequately described these dimensions and how they are rated (Leacock & Nesbit, 2007; Nesbit & Belfer, 2004; Vargo, Nesbit, Belfer, & Archambault, 2003; Nesbit, Belfer, & Vargo, 2002).

Overall Comments

The Fort Vancouver Mobile app with the "Kanaka" module has been designed with pedagogical and theoretical considerations in mind. Listed below are some of the pedagogical implications evident in the "Kanaka" module:

* The text describing the pictures or what to do with the pictures are close enough to the picture. This aligns with Mayer's (2009) spatial contiguity principle of multimedia learning resources.

* Learning objectives are clearly set in the introductory page and are followed through with headings showing clearly defined goals.

* There is a great deal of interactivity with the app. Users especially like the recording feature, and its integration throughout the app design provides beneficial learning opportunities.

* There is consistency in the layout (with font, size, and video). This is a good practice as users will increasingly become familiar with the interface with repeated exposure.

* Sufficient metadata were included and complied with international standards. Metadata like the creative team and description of the module were included.

* Apps and modules conform to WCAG 2.0 accessibility guidelines. The "Kanaka" module link is mostly accessible to disabled people. Tests with different mobile devices also show that the module is very accessible on most devices. Evaluator noticed, though, that the "sponsored by" logos do not have alternative texts, which would improve accessibility. A simple way to address this would be to provide "alt" tags in the pictures. Given that there is complexity in designing modules that are fully accessible, a more pragmatic approach might be to address simple accessibility issues through the use of "alt" tags.

* Ubiquity: The media player required for the user to see the application on the mobile display is widely available.

* Richness: The module loads quickly on mobile phones and videos play well with rich pixel quality.

* Flexibility: The module is viewable and of comparable quality on a variety of mobile devices.

* Display Reliability: The module displays consistently regardless of the browser, mobile device, and screen size.

LORI Scale

LORI stands for Learning Object Review Instrument. The nine items of LORI are used to evaluate learning objects. Each of the items of LORI has a scale ranging from 1 (Low) to 5 (High).

1. Content Quality: Veracity, accuracy, balanced presentation of ideas, and appropriate level of detail *The contents of this module are accurate and ideas are well presented. Out of a scale of 5, the module was rated a **5** in content quality.*
2. Learning Goal Alignment: Alignment among learning goals, activities, assessments, and learner characteristics *Learning goals are declared in the introductory page of the "Kanaka" module and are appropriate for the intended learners – visitors to the museum. There are some recording features that could be used to assess users' learning. It is recommended that the module should have more assessments that test whether the learning goal has been achieved or not. Out of a scale of 5, the module was rated a **4** in learning goal alignment.*
3. Feedback and Adaptation: Adaptive or interactive content *The module is adaptive and can be used in different learning situations. The recording feature could help relay feedback to designers. It was suggested that feedback for users should be incorporated into the design. Out of a scale of 5, the module was rated a **4** in feedback and adaptation.*
4. Motivation: Ability to motivate and interest an identified population of learners *The module is very motivating. The contents are really useful for the intended users. However, motivation with the module can be improved by embedding more feedback that compares the performance of learners with the goals of the module and how performance could be improved. Again, incorporating assessments or tests would be a good approach here. Out of a scale of 5, the module was rated a **4** in motivation.*
5. Presentation Design: Design of visual and auditory information for enhanced learning and efficient mental processing *Text is legible enough with good font size. The content is well segmented. All features are aesthetically appealing. Also, there is nothing in the app that could potentially constitute cognitive overload to effective learning. Out of a scale of 5, the module was rated a **5** in presentation design.*

6. Interaction Usability: Ease of navigation, predictability of the user interface, and quality of the interface help features *Good interface design, easy to navigate and predict. The module has clear instructions on how to navigate. Out of a scale of 5, the module was rated a **5** in interaction usability.*
7. Accessibility: Design of controls and presentation formats to accommodate disabled and mobile learners *The LOs conform to W3C guideline at level AA. It was suggested that alternative texts be provided for all images. Out of a scale of 5, the module was rated a **4** in accessibility.*
8. Reusability: Ability to use in varying learning contexts and with learners from differing backgrounds *This module can be readily used in other contexts and by other learners without modifications. Its use is not tied to the course or to any external resource. Out of a scale of 5, the module was rated a **5** in reusability.*
9. Standards Compliance: Adherence to international standards and specifications *Sufficient metadata were provided. Out of a scale of 5, the module was rated a **5** in standards compliance.*

Recommendations

The evaluator recommended that the following be done to improve the module.

High Priority (P1)

* Provide more simple quizzes, surveys or teaser information to (a) improve interactivity; and to (b) examine the user's understanding at the end of each video presentation.
* And consider the implications from the additional suggestions, detailed above.

Conclusion

The LORI evaluation of the app enabled us to examine the extent to which the design of the app was guided by relevant theories of learning. Indeed, Leacock and Nesbit (2007) claimed that one of the major contributions of LORI is to provide a quality tool "to support evaluation of multimedia learning objects" (p. 44). The use of LORI afforded the ratings and commentaries on nine dimensions of quality of the Fort Vancouver Mobile app: content quality, learning goal alignment, feedback and adaptation, motivation, presentation design, interaction usability, accessibility, reusability, and standards compliance. Overall, the LORI analysis found the Fort Vancouver Mobile app an effective learning resource. Specifically, independent evaluation found the app to be easy to use and that it presents accurate historical knowledge that aligns with the intended learning goal. Moreover, the interactive features of the app (e.g., recording elements) enhanced learning.

Mobile technology alone cannot provide the panacea for the issue of how to improve history education in the United States. To present findings that demonstrate learners are attracted to the novelty of a mobile app at the Fort Vancouver National Historic Site -- and might even be willing to give it a try -- would not be surprising. More revealing results in this study, then, come from the deeper observations and analyses formed during the construction and use of the app, or the lack of use of it, based on individual needs. In a free-choice learning environment, without coercive controls in place, the learners always have the opportunity to, as the saying goes, vote with their feet, or to close the app at any point, and to never return to it. They are under no obligation to pay attention, to learn, or even to keep the app, no matter how much work has been invested into its production. There is not even the slight guilt of having paid for it, in the Fort Vancouver Mobile case, since this app can be downloaded for free.

Researchers in environments like Fort Vancouver must also wrangle with diverse varieties of competing stimuli and understand that free-choice learners expect communication to get to the point quickly and to be fun. Several studies have demonstrated that people are unwilling to devote sustained attention to media and messages that are not entertaining, and that traditional interpretive and educational materials typically get less viewing time and attention than designers envision (Novey & Hall, 2006). Researchers, though, also have established the potential of interactive exhibits to attract and hold visitor attention for longer periods of time than non-interactive exhibits, to produce more learner engagement with interpretive media, and to improve learning conditions in ways that reach an immersive experiential state of intellectual and emotional awakening.

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